

Spill in 1980

Exchange rates table with columns for currency, rate, and country.

World news

US denies attempt to provoke Libya

The Reagan Administration insisted joint US-Egyptian military manoeuvres that began in the Mediterranean on Sunday were not intended to provoke Libya...

People Express grounds Frontier

PEOPLE EXPRESS, aggressive low-cost US airline, grounded its Frontier subsidiary and warned that Frontier could be forced into bankruptcy proceedings...

Butto faces charges

The Pakistan Government is expected to decide next week whether to charge against Miss Benazir Bhutto and other opposition leaders...

Tamil talks threat

Renewed separatist violence at the weekend in which 10 people were killed has threatened peace talks between the Sri Lankan Government and moderate Tamils.

Sikhs arrested

Indian police arrested two Sikhs suspected of assassinating General Arun Vaidya who commanded the army when the Golden Temple in Amritsar was stormed in 1984.

Fire penalties sought

French politicians sought stiffer penalties for arson after weekend fires swept through big tracts of scrub forest in the south-east, causing five deaths and leaving a trail of burnt houses and charred bush.

Soweto student riot

South African police fired with shotguns at a riot in Soweto after a patrol car was pelted with stones. One person was killed and eight wounded.

Unemployment rises

The number of jobless in the 12-nation European Community rose by 175,000 in July compared with June, largely because of school leavers, the community's statistics office said.

Shcharansky reunited

Former Soviet dissident Anatoly Shcharansky arrived in Vienna from Israel for a reunion with his 77-year-old mother, brother and other family members who left the Soviet Union to join him in Israel.

Bridge building

Denmark and Sweden opened talks on building a bridge or tunnel link between the two countries.

Food aid

The United Nations Food and Agriculture Organisation has approved food aid worth nearly \$26.5m for refugees in Pakistan and Central America and victims of strife and poor harvests in Lebanon.

Ugandan budget

In its first budget aimed at stimulating domestic production, Uganda's National Resistance Movement government discarded free market policies advocated by ex-President Milton Obote for a more managed approach to the economy.

Out of service

A gang which forged Iranian military service termination cards and sold them for up to \$75,000 each has been broken up.

Business summary

People Express grounds Frontier

PEOPLE EXPRESS, aggressive low-cost US airline, grounded its Frontier subsidiary and warned that Frontier could be forced into bankruptcy proceedings...

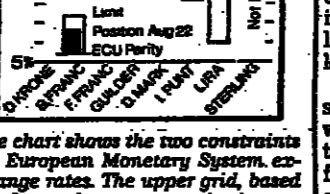
South Africa: Capital outflow

CAPITAL OUTFLOW from South Africa rose to a record in the first half of the year, the country's Reserve Bank said.

European Monetary System

SHARP FALLS by the Danish krone and French franc - and the D-Mark's continued improvement - gave rise to renewed speculation of a realignment within the EMS last week.

EMS Aug 22, 1986



WALL STREET

At 3pm, the Dow Jones industrial average was 10.97 lower at 1,876.83. Page 30

LONDON stock markets

were closed for a holiday. DOLLAR closed in New York at DM 2.0415 (DM 2.0410), SF 1.8435 (SF 1.8445), FF 6.80 (FF 6.8075) and ¥153.70 (¥153.15). The London market was closed. Page 19

STERLING closed

in New York at \$1.4805 (\$1.4875). The London market was closed. Page 19

GOLD: The London market

was closed. In Zurich the price was fixed at \$380.50 and in Paris it ended at \$386.50. In New York the December Comex settlement was \$386.50 against \$390.60 on Friday.

BANK OF ENGLAND

is planning an experimental auction of government securities, similar to the US Treasury's bond auction. Page 14; details Page 16

ALBERT WAINLOWER

is to step aside as chief economist at First Boston, the US securities firm, although he will continue as a managing director and senior adviser. Men and Matters, Page 12

FRUEHAUF, US automotive

parts and truck company, agreed to a sweetened \$1.12bn leveraged buy-out bid led by Merrill Lynch, Wall Street securities firm, and Fruehauf's senior managers. Page 16

UNILEVER, Anglo-Dutch food

and detergents group, has raised its stake in Naarden, Dutch flavours and fragrances group, from 40 per cent to 49 per cent. Background, Page 17

Cameron President says volcanic gas killed 1,200

AT LEAST 1,200 people are feared to have been killed by toxic gas escaping from a remote volcanic lake in north-west Cameroon, the country's President Paul Biya said yesterday. Mr Georges Ngango, Information Minister, said earlier that military reports from the scene estimated a death toll of at least 2,000. Mr Ngango said that between 200 and 300 people suffering from the effects of the gas fumes were being treated in hospital and that army teams were searching the 4 sq mile disaster area for more victims.

Some survivors of the leak, which occurred on Friday, have been evacuated by helicopter, but most are reported to be still in the affected area, around Lake Nios about 250 miles north-west of Yaounde, the capital. Early rescue attempts had been hampered by a lack of breathing apparatus and oxygen. President Biya, who visited the area on Sunday, has declared it a disaster zone and appealed for international aid. A French medical team arrived in the country yesterday and Britain, the US and Switzerland have also pledged assistance.

The Foreign Office in London said last night that Britain would give "speedy and sympathetic" consideration to any request for aid, although no official appeal had been received. Mr Shimon Peres, the Israeli Prime Minister who arrived on an official four-day visit to the West African country yesterday, took a 20-member army medical team equipped with oxygen and breathing apparatus to help with rescue efforts.

The Government said that the gas which caused the disaster was hydrogen sulphide. It smells like rotten eggs and can paralyse respiration if breathed in sufficient concentrations. The gas, which is often found in volcanic areas, inhibits the functioning of the central nervous system. French and US scientists said, however, that the gas could have been either carbon monoxide or carbon dioxide, thought to have been the cause of a similar incident in the same mountain chain in 1984, in which 30 people died.

Soviets admit design flaws at Chernobyl

MAJOR FLAWS in the design must share the blame with human error for the nuclear reactor catastrophe at Chernobyl, it was disclosed here yesterday at the international "post mortem" on last April's accident. Academician Valery Legasov, a leading Soviet nuclear scientist, heading a large Soviet delegation to the meeting being hosted by the International Atomic Energy Agency (IAEA), spoke of a "tremendous psychological mistake on the part of the designers of this reactor". Dr Ivan Emelyanov, chief designer of the RBMK reactor, was dismissed last month.

Japanese to pay 'dump' levy on copiers

THE European Commission yesterday announced anti-dumping duties of up to 15.8 per cent on plain paper Japanese photocopiers, after one of the biggest investigations of its kind launched from Brussels. All the major Japanese manufacturers will be affected, including Canon, Ricoh, Toshiba and Minolta. The duties, which are provisional and come into effect tomorrow for at least four months, compare with alleged "dumping margins" (the difference between domestic and export prices) of between 7 and 69 per cent, although most were found to be in the 20-45 per cent range.

Mexico plans to draw on \$1.6bn bridging loan

MEXICO hopes to start drawing this week on the \$1.6bn bridging loan agreed by leading industrial countries and banks to bolster its reserves while it negotiates longer term assistance in servicing its \$98bn foreign debt. The drawings will come from the \$1.1bn to be provided by the US Treasury as well as the central banks of industrial countries and five Latin American nations. Commercial banks which are to lend \$500m have made their portion of the loan conditional on progress first being achieved in syndicating some \$60m in fresh, medium-term credits to the Government of President Miguel de la Madrid.

Cadbury buys 30% of Dr Pepper for \$17.5m

CADBURY SCHWEPPE'S, the UK confectionery and soft drinks group, has expanded its US interests by buying a 30 per cent stake in the Dr Pepper Company, makers of the secret formula drink which has 7 per cent of the US soft drink market. In June, Cadbury-Schweppes spent \$230m buying the Canada Dry and Sunkist soft drinks businesses. Cadbury Schweppes said yesterday that the group had concluded a \$17.5m deal with financial institutions and the Dr Pepper management to take the stake as part of a leveraged buyout. "Our business is being geared very strongly towards confectionery and soft drinks" it said.

Dr Legasov said the designers of the 1,000 MW reactor had failed to foresee the combination of mistakes and deliberate violation of safety regulations which caused the reactor to explode. He said the erring operators were completing tests on new equipment in a hurry because, if they were delayed, they would have to wait at least another year.

The move, which is likely to be fiercely contested by the companies, is a further sign of the Commission's determination to pursue what it sees as unfair Japanese pricing practices. In the past couple of years, anti-dumping duties have been imposed on Japanese electronic typewriters, excavators, roller bearings and outboard motors.

Nonetheless, the fact that more than \$1bn should become available to Mexico this week will help to secure a continued flow of interest payments to bank creditors while the rest of the package is negotiated. Talks last week in New York between Mr Angel Gurría, the senior Mexican Finance Ministry official responsible for debt negotiation, and leading creditor banks, were mainly designed to pave the way for the start of drawings on the bridging loan.

Dr Pepper will have four shareholders under the new scheme agreed late on Friday. According to Mr Hicks, his company together with the management, Cadbury Schweppes and Shearson Lehman will each hold about 30 per cent of the reduced equity totalling \$58m. Forstmann Little is to retain a 5 per cent stake.

Fermenta's unions reject Montedison

LOCAL TRADE unions in Fermenta, the Swedish chemicals and biotechnology group, yesterday rejected the planned takeover of the company by Montedison, the Italian chemicals and health care group, plunging the future ownership of the company into fresh uncertainty. Trading in Fermenta shares was suspended until further notice by the Stockholm stock exchange pending clarification of the Montedison deal. In July, the Italian company agreed in principle with Mr Refaat El-Sayed, the Egyptian-born Fermenta group chief executive, to buy his controlling stake of some 78 per cent of the votes and 44 per cent of the equity. The takeover would be worth at least SKr 3bn (\$441m).

Japanese photocopyers

Table with columns: Company, Dumping margin (%), Anti-dumping duty (%).

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Advertisement for Phillips & Drew Futures Limited, including text about futures and options, and a graphic of a book titled 'UNDERSTANDING FUTURES AND OPTIONS'.

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OVERSEAS NEWS

Pentagon denies attempting to provoke Libyans

BY REGINALD DALE, US EDITOR, IN WASHINGTON

THE REAGAN Administration yesterday insisted that joint US-Egyptian military manoeuvres that began in the Mediterranean on Sunday were not intended to provoke Libya, and had been planned for many months.

John Deere shuts plants after union calls strikes

By William Hall in New York

JOHN DEERE, the world's biggest farm equipment manufacturer, which is expected to post its first annual loss in over 50 years, yesterday closed all but one of its US factories after its workforce began selective strikes at three key plants.

The United Auto Workers (UAW), the biggest of Deere's unions, ordered its members to strike at three facilities at midnight on Friday, and Deere said yesterday that it had been forced to close all of its union organised plants as a result.

However the union described the move as a lock-out and ordered its workers to turn up for work yesterday. About 12,500 workers are directly affected by the dispute. Another 9,000 union members are currently laid off but have the right of recall.

KAMPALA BUDGET ABOLISHES DUAL EXCHANGE RATE

Uganda discards Obote's policies

BY OUR KAMPALA CORRESPONDENT

IN ITS first budget the government of Mr Yoweri Museveni's National Resistance Movement (NRM) has discarded the free market policies advocated by Uganda's former President Milton Obote for a more managed approach to the economy.

Abolishing the dual exchange rate introduced as a compromise measure in May, the Government has acted to peg the shilling at the rate for priority imports of 1,400 shillings to one US dollar compared with the former market exchange rate of 5,000 shillings to the dollar.

The system rapidly hit the prices of many goods imported privately, contributing to inflation rate estimates at up to 200 per cent. The drastic revaluation will be accompanied by the introduction of a new currency in several months' time.

In Kampala one investor described the new exchange rate as nightmarish, saying it will be very difficult to make ends meet with the rising cost of labour and fuel.

Western diplomats also expressed doubts saying the big question was whether it would affect the parallel market. Hard currency on the black market fetched two to three times the official rate yesterday.

The black market has been boosted in recent months by a shortage of hard currency.

It also remains to be seen whether the new rate will lower the cost of consumer goods. Local shopkeepers automatically raise prices on Saturday afternoons and many people appear baffled about the

budget's real implications and complained of rising fuel prices. The petrol price rose by 100 per cent last week.

Mulema described the financial year 1988/89 as abnormally difficult because of the cost of relief to areas affected by war and an increased wage bill for the police and army.

The result was a deficit of 104.8bn shillings (\$5m), he said. The budget deficit in the current year, to be financed by borrowing, would be 349.7bn shillings (\$249m), with expenditure at 1,127.5bn (\$806m) exceeding revenue at 777.8bn (\$556m), he added.



President Museveni

banks opening rural branches are to be abolished from start of 1987. Corporation tax on financial institutions has risen by 10 per cent and in commercial activities will double.

Argentine ministers discuss economic package

BY TIM COONE IN BUENOS AIRES

THE NOMINATION of Dr Jose Luis Machinea, the deputy Economy Minister, as the new president of Argentina's central bank, has raised expectations over the launching of a package of economic measures shortly to combat the unexpected growth of inflation in the Argentinian economy in July and August.

Economic ministers held lengthy discussions over the weekend to analyse the principal causes of the acceleration

in the rate of inflation and to adopt measures which are expected to include a relaxation of import controls on basic consumer items, especially foodstuffs, a continuation of a policy of regular mini-devaluations and further tightening of monetary controls.

Following the announcement of his appointment, Dr Machinea said that the economic team "will now act with greater coherence having

clearly defined the monetary policy to be followed."

Mr Juan Sourrouille, the Economy Minister, told bankers and economists gathered for the inauguration of an Argentinian banking conference yesterday that the rise in the inflation rate was a result of current seasonal food shortages.

He acknowledged that the inflationary reaction was greater than predicted but dismissed claims that the Austral Plan, the Government's economic

stabilisation programme, had collapsed. "We are now in a better condition to combat inflation than we were over a year ago when the Austral Plan was launched as the fiscal deficit and balance of payments are now under control. This gives us room for manoeuvre to stabilise prices," he said.

He added that Argentina's financial system also needed "cleaning up through the institutionalisation of trade

black market in foreign exchange and credit dealings that have mushroomed over the past year due to tight restrictions on credit creation by the official banking system. Many of the black market operators stand to lose heavily on unsupported futures deals in US dollars which have to be closed on Friday. The 30 per cent drop in the value of the Austral against the US dollar this month has left many dealers heavily exposed.

Venezuela to pay \$750m of foreign debt this year

BY JOSEPH MANN IN CARACAS

A HIGH-LEVEL official at Venezuela's Ministry of Finance said this weekend that the Government planned to pay foreign banks a \$750m (\$500m) principal payment before the end of this year.

Mr Jorge Marciano, Finance Director at the Ministry, also said he did not want to comment on whether the Government would ask foreign banks to loan it \$500m to help it comply with the lump-sum payment. He added that it was not appropriate to mix together comments about an agreed-upon loan payment and a possible future loan.

Mr Marciano's comments referred to a sticky problem that developed after the Venezuelan Government and foreign banks signed a loan restructuring agreement on February 22. The agreement, covering debts of \$20.8bn in public sector and around 490 foreign banks and financial institutions, called for Venezuela to make a \$750m

principal payment at the time the restructuring officially becomes operational, scheduled for the end of 1988. After oil prices fall earlier this year, the Government had second thoughts about making the \$750m "down payment," thus jeopardising the restructuring accord.

Now, however, it appears the administration of President Jaime Lusinchi intends to comply with the lump-sum payment. It is still not clear, though, whether the Government will ask banks for assistance in making this payment.

Referring to some \$5.9bn in private sector debt that has recently caused concern among international bankers, Mr Marciano also said the Government may develop a plan for allowing repayment of these loans to be spread over a period of 2-12 years. He added, however, that a final decision on this matter must be made by the Venezuelan Cabinet.

S. Africa and Mozambique clash over Nkomati Accord

BY ANTHONY ROBINSON IN JOHANNESBURG

CHARGES AND counter charges are flowing again between South Africa and Mozambique over alleged infringements of key sections of the March 1984 Nkomati Accord under which Mozambique undertook to prevent the African National Congress (ANC) operating from the country and South Africa agreed to cease support for Mozambican National Resistance (MNR) rebels.

South African security forces believe ANC guerrillas involved in planting landmines in the Eastern Transvaal have been moving through Swaziland from Mozambique while Mozambican sources allege that the MNR has received additional military supplies for their campaign to interrupt the road and oil pipeline links between Zimbabwe and the port of Beira.

Mozambican allegations that supplies have been airlifted to MNR rebels from South Africa meet the standard refusal of the South African authorities to either confirm or deny what they regard as "propaganda."

Meanwhile in Angola Dr Jonas Savimbi, leader of the rebel Unita movement, told foreign correspondents that US military assistance over the past four months had helped to shift the balance of forces in Unita's favour in the long civil war with Cuban and Soviet-backed Angolan government Fapla forces.

A 23-year-old black man was killed and eight injured yesterday when police fired birdshot at a crowd of 500 people who were stoning their vehicle, AP reports from Johannesburg.

The clash occurred outside a high school in Johannesburg's main black township, according to the Bureau for Information, which said those injured ranged in age from 14 to 25. Earlier, the Bureau said a five-year-old black girl asleep in the home of a town councillor was killed by a hand grenade thrown through the window of her room.

All-out attack on Iraq urged

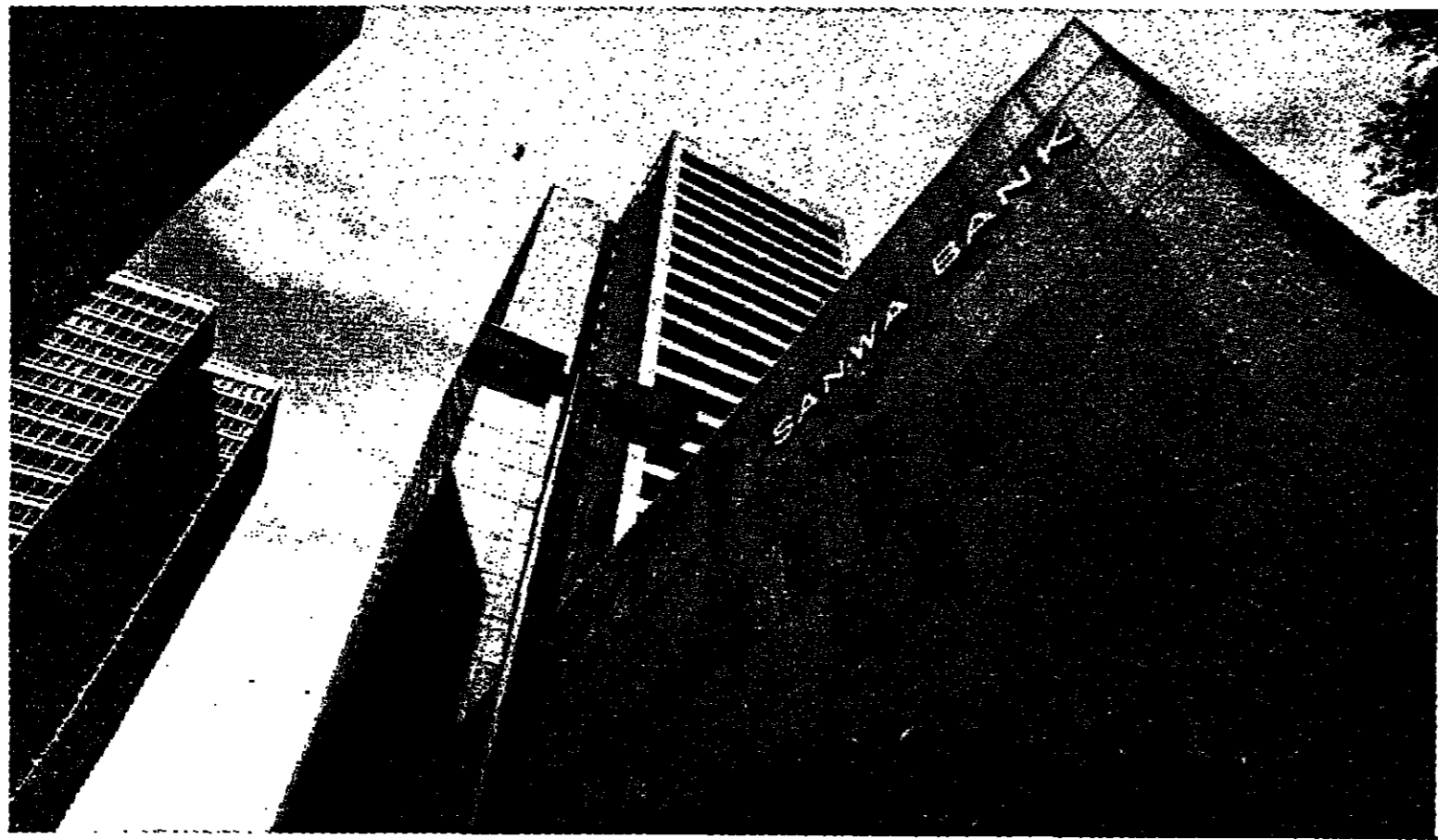
Iran's Parliamentary Speaker Ali Akbar Hashemi Rafsanjani has called for an all-out attack on Iraq to prevent Iran's Gulf war enemy from reorganising its forces, the Iranian news agency IRNA reported at the weekend.

Reuter reports that Mr Rafsanjani told a Tehran seminar that Iraq should be given no chance to reorganise its forces and that Iran "by launching an all-out attack, should deprive the enemy from carrying out its mischiefs."

He denounced what he termed imperialist plots "to force the Islamic revolution to kneel down."

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OVERSEAS NEWS

# Wheat producers assail EEC, US export subsidies

BY RICHARD HUBBARD IN CANBERRA

CANADA came under intense pressure to adopt the hardline views of Australia and Argentina against agricultural subsidies by the US and the European Community at a special meeting of the three leading wheat exporting nations in Cairns, north-east Australia, yesterday.

Mr John Dawkins, the Australian Trade Minister, called on the EEC and the US to reduce and eventually remove production and export subsidies and forecast that the crisis facing international grain exporters was likely to deepen in the next few months.

The three nations together produce around 44 per cent of world wheat exports, with the US and European Community accounting for most of the rest.

After their meeting yesterday the three nations agreed that in the short-term production and release of surplus stocks to the export market by the US and EEC had to be restrained.

Mr Charles Mayer, the Canadian Minister placed the blame for the current wheat crisis firmly at the feet of the EEC. "The US is at least talking about reducing production," he said.

Mr Dawkins said the three nations rejected market sharing, as proposed by the EEC, as a long-term solution to the problem. "The obligation rests with those who have engaged in market subsidies and created the problem," Mr Dawkins said.

The three wheat exporters held preliminary discussions ahead of a 14-nation conference of agricultural trading nations due to begin discussions today. Brazil, Chile, Colombia, Fiji,

Hungary, Indonesia, Malaysia, New Zealand, the Philippines and Uruguay are also attending the conference, which aims to ensure that agriculture gains top priority at next month's General Agreement on Tariffs and Trade (GATT) talks at Punta del Este in Uruguay.

The conference was called by the Australian Government, which is facing severe balance of payments problems because of the erosion of export earnings due partly to the lower prices for leading agricultural products on world markets.

The Government has identified the subsidised trade war between the EEC and the Americans as one key cause of lower world prices for agriculture.

In his opening address to the conference, Mr Bob Hawke, the Australian Prime Minister, made a call for unity against the trading blocs of the US and the EEC, and warned that participants faced a long haul in changing the world trading system.

The European Community denied yesterday that it had bettered an offer by the US to sell 4m tonnes of subsidised wheat to the Soviet Union, Reuter writes from Brussels.

The denial was issued by EEC officials in response to a statement by Mr Dawkins that the EEC had countered Washington's offer with a better one.

The US announced this month that it was offering Moscow the wheat with a \$13 a tonne subsidy.

EEC grain trade sources said Mr Dawkins might have been referring to an EEC committee decision to make available for export \$50,000 tonnes of soft wheat in store in the Community.

# France speeds profit share legislation

By David Houston in Paris

THE FRENCH Government is bringing forward legislation to widen employee participation in both the management of industry and in the profits it makes.

Ministers met yesterday to finalise details of two decrees to be put before the Cabinet early next month which reflect long-held Gaullist ideas on encouraging worker ownership and profit-sharing schemes in industry.

At the same time, in pushing forward the legislation now, the right-wing government of Mr Jacques Chirac, is anxious to show that it is no less progressive than the Socialists over labour issues.

The proposals have received a mixed welcome from trades unions—with the more left wing unions being reluctant to be drawn into co-responsibility for industrial management.

Of the two decrees, the first will allow worker representatives to have up to a third of the seats on company boards. The measure will be voluntary and at the initiative of companies. It requires the approval of a two-thirds majority in the general assembly.

The new law will replace and extend legislation brought in by the Socialists to "democratise" the public sector after the nationalisations of 1982. This law, which required nationalised companies to have work representatives on their boards, will progressively expire as companies are privatised.

The intention of the second decree is to go before the Cabinet is to simplify and broaden existing schemes with the emphasis on encouraging long term savings within a company.

The draft decree envisages increasing the amount that companies must set aside from profits for a reserve fund for employees.

# Islamabad ponders what to do with Bhutto

BY JOHN ELLIOTT IN KARACHI

THE PAKISTAN Government is expected next week to decide what charges to bring against Miss Benazir Bhutto and other leaders of the country's political opposition, who were jailed nearly two weeks ago, when violent demonstrations swept through the country protesting against the ruling regime of President Zia ul-Haq.

Calm has now been restored throughout the country and there have been no big demonstrations over the weekend, although a growing problem of armed attacks by bandits is continuing to disrupt the southern province of Sind, which was at the centre of the political protests and is now being patrolled by the army.

Tension has eased in the southern city of Karachi, the country's commercial centre and the capital of Sind, where there were major riots which caused concern among the business community.

In an interview yesterday, Mr Syed Ghous Ali Shah, Sind's



President Zia ul-Haq

chief minister, denied reports that charges for the capital crime of sedition and treason had been filed against Miss Bhutto, whose father, President Zulfikar Ali Bhutto, was executed in 1979. She now leads the Pakistan People's Party, and is trying to force the Government to call early elec-

tions. Mr Shah said that "a lot of reports" had been filed against various groups of people for charges including murder, which in Pakistan carries a penalty of hanging. But "her names does not appear because she was not on the spot."

He added that she "could be linked if people who have been named implicate her" and added: "If evidence comes against her, she will not be an exception—she will be treated the same as everyone else."

However, it seems unlikely that President Zia will want to upset the country's political stability by making her a martyr. Her present 30 days of detention expires in two weeks' time.

President Zia returned to Pakistan on Saturday from Saudi Arabia, where he had on a two-week Moslem pilgrimage, missing the crisis that erupted after processions and meetings were banned on Pakistan's August 14 independence

day by Mr Mohammed Khan Junejo, the Prime Minister.

President Zia, who does not appear to have suffered politically as a result of the crisis, reviewed the political and security situation with senior officials. Mr Junejo, whose credibility has taken a knock, has started meeting members of Pakistan's parliament in individual states in an attempt to build a political consensus for the action he ordered against the demonstrations, which built up into Pakistan's most serious outbreak of violence since an uprising in Sind in 1983.

Estimates of those killed range from official figures of 20 to over 40 and more than 2,000 people are believed to have been arrested. Mr Shah said only 85 were still being held in Sind.

The tough army action in Sind, coupled with a more relaxed regime in the Punjab after four people were killed at the beginning of the demonstra-

tions, in effect squashed the attempts by Miss Bhutto's party to mount a big offensive against the Government.

The party had intended to launch this offensive, possibly including some civil disobedience and disruption of communications from September 20. But it decided to bring this forward to August 14 as a response to Mr Junejo's ban on independence day meetings.

That played into the hands of the Government, which wanted to deflect the opposition away from the September 20 target. Political activists in the Punjab failed to support demonstrations in the Sind and this led to the campaign collapsing because no alternative organisation or system of communication had been prepared to take over when the top leaders were put in jail.

Miss Bhutto's credibility as a political leader has consequently suffered, but she is expected to continue to have considerable personal appeal

# Indonesia and Philippines plan common market

INDONESIA and the Philippines agreed yesterday to create a common market among the six members of the Association of South East Asian Nations (Asean).

The political discussions focused on the Kampuchean conflict, Soviet leader Mikhail Gorbachev's Asian policy speech last month and border issues between the neighbours.

Mr Concepcion said the two countries agreed on a vision of

creating a common market among the six members of the Association of South East Asian Nations (Asean).

The grouping, which links Indonesia and the Philippines with Thailand, Singapore, Malaysia and Brunei, will hammer out the common market plan at an Asean summit meeting next July in Manila, he said.

The idea was being pushed especially by the Philippines and Thailand with support from Malaysia and would figure prominently in Mrs Aquino's talks with Singapore Prime Minister Lee Kuan Yew tomorrow.

Mr Concepcion said Indonesia suggested that Asean should move gradually toward a common market over the next 14

years through a series of "intermediate steps."

"We have to review the entire spectrum of trade, finance and currency policies in evolving a zero-duty common market in the next 14 years."

Products which now had high import tariffs would be gradually taken off the preferential list until the vision of a duty-free system is achieved

# Test freeze gives US advantages, says Moscow

THE chief of staff of the Soviet armed forces, Marshal Sergei Akhromeyev, said yesterday Moscow's nuclear test moratorium had given the US some advantages but had not altered the East-West military balance.

Mr Akhromeyev said the Kremlin's civilian leadership and the military establishment had decided to extend the test freeze until January 1 because the political benefits outweighed the costs to the Soviet

nuclear programmes. "We had to accept a certain damage to ourselves, but we took into account that this damage was tolerable," Mr Akhromeyev told a news conference.

"The US had conducted 18 nuclear tests since the Soviet moratorium took effect, including three unannounced low-yield tests in August 1985, autumn 1985 and spring 1986, he said. The test freeze began on August 6 last year.

# US considers short-term help for Bolivia

By Peter Montagnon, Euromarkets Correspondent, in London

THE US Treasury is considering short-term financial assistance to Bolivia which is facing an acute shortage of foreign exchange, exacerbated by its recent crackdown on the narcotics trade.

The move, announced last week, is likely to be seen as further evidence that the so-called Baker Plan to ease the developing countries' debt crises is finally being implemented. The plan was launched by the US at the International Monetary Fund meeting in Seoul last year.

The Treasury's statement, which gave no figure for any likely loan, praised Bolivia for its efforts in reducing inflation which has been cut dramatically, to 50 per cent in the first six months of this year from 8,000 per cent last year.

Commercial bankers who have been working on Bolivia's \$3bn foreign debt said the Treasury move was an unprecedented one which suggested it could also be designed as an incentive to Bolivia for its action on the drugs front.

They said such short-term financial assistance was normally only granted to countries with much larger foreign debts, such as Mexico, in the immediate aftermath of an economic policy agreement with the IMF.

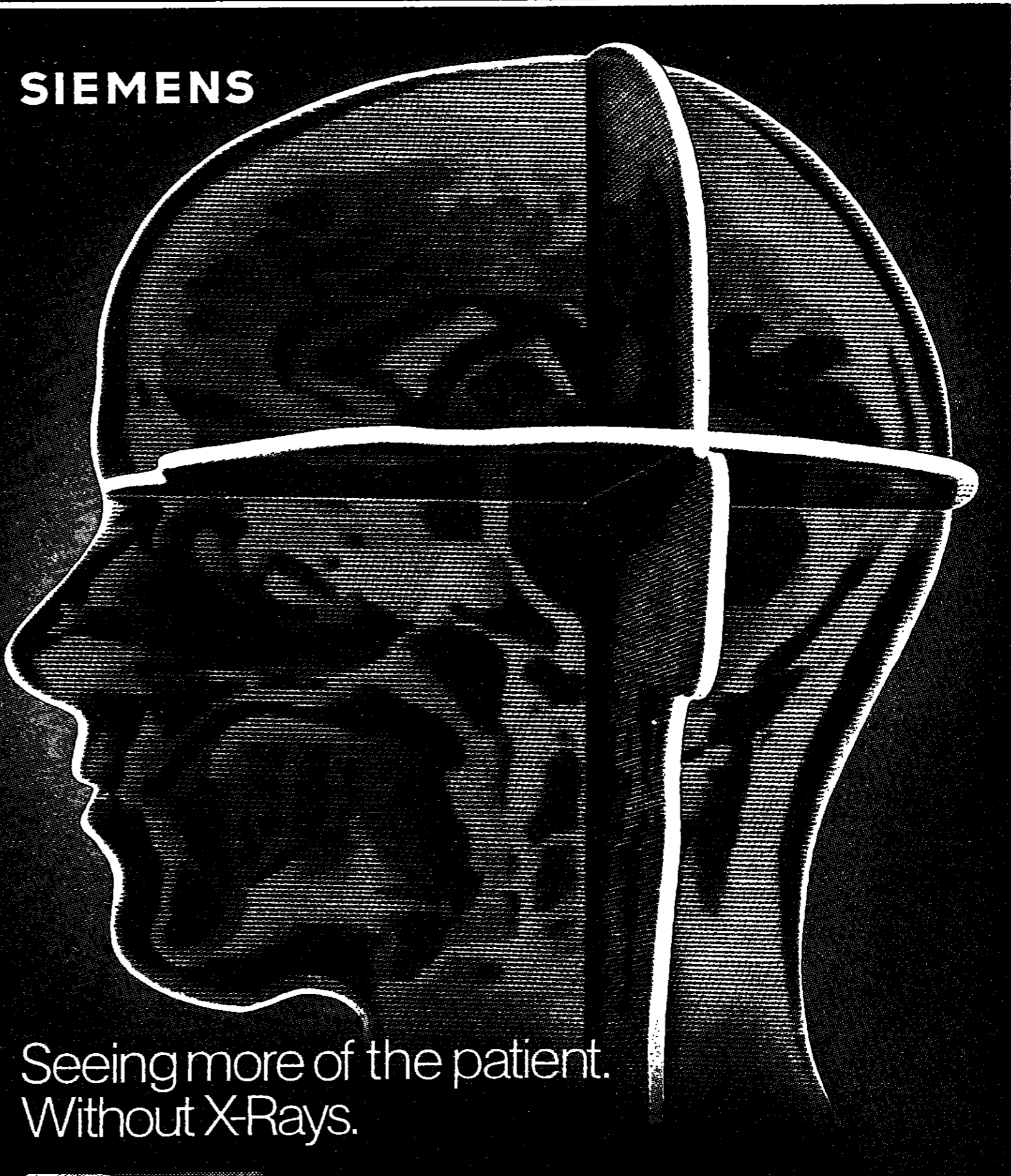
It was also unusual for the US to consider a bridging loan without determining clearly how its loan was going to be repaid, they said.

# Five die in Cote d'Azur forest fires

FIRES THAT have ravaged the pine and mimosa-clad hills above the French Cote d'Azur over the past three days seemed to be losing momentum last night, reports our Paris staff.

Five people were killed and 8,500 hectares of hillside burnt in a second wave of forest fires which hit the South of France this year. Local officials suspect that some of the fires were deliberately started. A young West German tourist arrested yesterday on charges of starting a fire, admitted he had tried to start another the day before in the hope that cars would halt and give him a lift.

Worst damaged were the hillsides between Grasse and Cannes where the flames destroyed 7,000 hectares of pine forest and scrub land, including wild mimosa. In the wake of the worst drought the South of France has known for 30 years the flames spread at lightning speed. Over 2,000 hectares around Lacaze above Nice were also burnt.



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Although it emits no rays, it's able to scan and see areas other diagnostic systems cannot, and together with exceptionally high picture quality, helps make diagnosis more precise. The first are now in use in major hospitals in London.

Doctors are able to see more patients too, as MAGNETOM cuts down waiting time. As one person is being examined details can be fed into its memory to be called up while the next patient is being scanned.

Siemens is one of the world's largest and most innovative electrical and electronics companies. Here in the UK we employ around 3000 people in Research & Development, Manufacturing, Engineering, Service and other customer related activities.

Siemens technology embraces computer and business communication systems, telecommunications, industrial automation and medical engineering.

Siemens Limited, Siemens House Windmill Road, Sunbury-on-Thames Middlesex TW16 7HS Telephone: 0932 785691

MAGNETOM® magnetic resonance diagnostic system.

Innovation · Technology · Quality: **Siemens**

**The European Banking Traded Currency Fund Limited**

NOTICE OF THE SECOND ANNUAL GENERAL MEETING OF Shareholders to take place on the 26th day of September, 1986 at 11 am.

NOTICE is hereby given pursuant to the Articles of Association of The European Banking Traded Currency Fund Limited ("the Company") that the Second Annual General Meeting of the Company will take place on the 26th day of September, 1986 at 11 am at EBC House, 1-3 Seale Street, St. Helier, Jersey, Channel Islands for the purposes of considering and if thought fit, passing the following Ordinary Resolutions:

**Resolutions**

- That the Financial Statements for the period ended 31st March, 1986 together with the Report of the Directors and the Auditors thereon be received, approved and adopted.
- That Messrs. Coopers & Lybrand who have signified their willingness to continue in office be and are hereby appointed the Auditors of the Company for the ensuing year and that the fee payable to them in respect of the year to 31st March, 1987 be determined by the Directors.

By order of the Board  
EBC Trust Company (Jersey) Limited  
Secretary

Dated the 18th day of August, 1986.

NOTES

- The holder of a Continental Depository Receipt ("CDR") may exercise his voting rights by depositing the CDR at the office of Amsterdam Depository Company N.V., 172 Spuistraat, 1012 VT Amsterdam, The Netherlands (the "Depository") and by instructing the Depository as to the exercise of the voting rights attached to the Shares evidenced by such CDR. In the absence of such instructions, the Depository will exercise such voting rights or refrain from doing so, as it thinks fit in the interests of the holder.
- There are no service contracts with the Directors.

**crédit foncier de france**

¥ 15,000,000

Guaranteed Floating Rate Notes Due 1997  
For the six months  
27th August 1986 to 27th February 1987

In accordance with the provisions of the Notes, notice is hereby given that the rate of interest has been fixed at 4% per cent per annum, and that the interest payable on the Interest Payment Date 27th February, 1987 against Coupon No. 3 will be:

¥ 24,278 per ¥ 1,000,000 and ¥ 242,778 per ¥ 10,000,000.

The Industrial Bank of Japan, Limited - Agent Bank

OVERSEAS NEWS

WORLD TRADE NEWS

Tan admits guilt to Pan-Electric collapse charge

BY WONG SULONG IN KUALA LUMPUR

MR TAN KOON SWAN, the prominent Malaysian businessman and politician, yesterday pleaded guilty in the Singapore high court to an amended charge of abetment in criminal breach of trust related to the collapse of Pan-Electric Industries, the Singapore marine salvage, engineering and hotel group.



Mr Tan: still face 14 possible charges

Korean succession strengthened

BY STEVEN B. BUTLER IN SEOUL

A SWEEPING shake-up in the leadership of South Korea's ruling Democratic Justice Party (DJP), announced at the weekend, has strengthened the position of Mr Roh Tae-woo, the party chairman, as heir-apparent to the Korean President.

The shake-up, which was orchestrated by Mr Roh, recon-stituted the party while bringing in a number of prominent politicians and former military officers to fill senior positions.

The shakeup was also designed to improve the party's public image as it negotiates with the Opposition over constitutional reform. The Opposition is campaigning for a direct popular vote for a strong President.

Christian Tyler reports on selling power stations to customers who cannot afford them Power engineers fight credit war for exports

THERE IS a new kind of engineer in the power plant industry these days. He wears a pin-striped suit and spends most of his time in banking parlours dreaming up sophisticated loan packages. He is called the financial engineer: without him, no plant-builder can hope to export to the power-hungry developing nations.

World-class design, computerised production and tireless salesmanship are no longer enough in a buyers' market, where delivery times have halved in the past decade. If you want to export a power-station, the makers say, cheap and generous credit is essential.

ness, NEI Parsons (formerly C. A. Parsons) on Tyneside, had a feast of home orders during the 1960s. With customers queuing at the gate, traditional export markets, such as Australia and Canada, were left unattended, and new competitors, especially the Japanese, walked in.

By the mid-1970s, things were looking bad, as home orders melted away and the company found itself ill-equipped to compete abroad. The power business was saved by government agreement to bring forward its ordering of the next Drax power station in Yorkshire, and Reynolds Parsons and Clarke Chapman were merged to become NEI.



Mr Anderson: 12 months to get a commitment

All this has been accompanied by what Mr Richard Maudslay, the 59-year-old managing director of Parsons, calls "a ruthless re-examination of all the overhead costs."

three units to Botswana and is sub-contractor to Hyundai of South Korea for the Al Mussab power station in Iraq. A turnkey contract for the Rihand power station in India, won with the help of British government aid, has been a less happy experience. The work fell badly behind schedule, but is now said to be up to its revised target. The company hopes to land the contract for Rihand's extension.

China, Mexico and Turkey, among others, all need power stations, but cannot afford to buy them off the shelf. As a result, plant builders are forced into temporary international alliances in order to tap the aid funds of various governments.

tractors, such as NEI, have put such pressure on their own Government to sharpen its responses to international credit competition. Mr Anderson, the deputy chairman, was one of those who lobbied for the recently-announced £300m soft loan facility for China.

Concessions can be as important as cash in this buyers' market. For example, some Parsons people believe they lost the order for a fourth unit in Botswana because the Japanese threatened to pull out their other commercial ventures in the country, unless a Japanese company got the order.

EXPORTS LIKELY IN DECEMBER

Iran 'to resume Soviet gas sales'

IRAN EXPECTS to resume natural gas exports to the Soviet Union this year for the first time in more than six years, the national news agency Irna said yesterday, Reuter reports from Tehran.

and was unlikely to be able to take its former daily average throughput of 28m cubic metres.

Iran said Soviet and Iranian experts would complete a report by November on the condition of the KAT-1 pipeline used to carry gas north from oilfields in southern Iran. Diplomats had said earlier this year that the 16-year-old pipeline was rusted

SHIPPING REPORT

Mahathir and Lee agree over gas and water

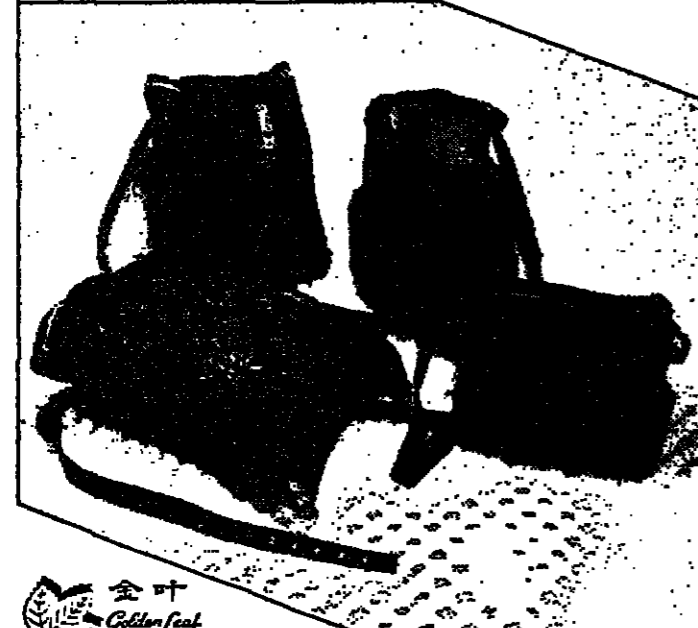
A BREAKTHROUGH has been achieved in talks for the long-term supply of natural gas and water to Singapore by Mr Mahathir, following a meeting here over the weekend between Dr Mahathir Mohamad, the Malaysian Prime Minister, and his Singapore counterpart, Mr Lee Kuan Yew.

Markets more cheerful

THE TONE in shipping markets was cheerful last week, with rates finally moving ahead on the dry cargo market and continuing to be firmer for tankers.

中國安徽

"GOLDEN LEAF" Canvas Bags



"Golden Leaf" Brand canvas bags from Anhui, China, are made of top quality 100% cotton canvas. Of exquisite colours, they are available in all sizes and in a wide variety, including school bags (single and double belt type), hand bags, rucksacks and bags for mountaineers.

The inside is coated with plastics. Our bags are thus waterproof, strong and durable.

China National Light Industrial Products I/E Corp., Anhui Branch Imp. & Exp. Building, Jinchai Rd., Hefei, China. Tel: 61835 Telex: 90016 AHIND CN Cable: "INDUSTRY" Hefei

Anhui Animal By-Products

Anhui Animal By-products Branch of China National Native Produce and Animal By-products I/E Corp. is the sole lawful sales agent specialising in the import and export of animal by-products in Anhui.



China National Native Produce & Animal By-Products I/E Corp., Anhui Animal By-Products Branch I/E Building, Jinchai Road, Hefei, China. Telex: 90012 ANIXC CN Cable: ANHUIX Tel: 61685, 61269

World Economic Indicators

Table with columns for Industrial Production (1980=100) and % change over previous year for various countries including US, UK, W. Germany, France, Netherlands, and Japan.

Advertisement for Burlington Industries, Inc. featuring a \$75,000,000 7% Convertible Subordinated Debenture Due 2001. Lists various international banks and financial institutions as agents.

# WORLD CAR MARKETS

UNITED STATES				JAPAN				WEST GERMANY				UK			
1985		1986		1985		1986		1985		1986		1985		1986	
Domestic	Imports	%	%	Domestic	Imports	%	%	Domestic	Imports	%	%	Domestic	Imports	%	%
1,434,967	77,111	4.1	4.1	1,547,227	98,446	6.4	6.4	874,682	68,669	7.9	7.9	389,539	41,281	10.5	10.5
5,231,627	100.00			1,571,451	100.00			1,256,697	100.00			363,626	100.00		
<b>DOMESTIC</b>				<b>DOMESTIC</b>				<b>DOMESTIC</b>				<b>DOMESTIC</b>			
General Motors				Toyota				Volkswagen				Ford			
2,436,247 46.5				675,988 43.0				280,906 22.0				246,973 26.1			
Chrysler				Nissan				Audi				Rover Group			
1,906,493 36.5				714,361 45.4				72,586 5.8				170,263 18.0			
Honda				Honda				General Motors-Opel				General Motors			
892,591 17.1				189,796 12.0				362,880 28.9				163,154 17.3			
Volkswagen				Mazda				Mercedes				Peugeot-Talbot			
83,651 1.6				95,474 6.1				195,641 15.6				38,664 4.3			
American Motors				Mitsubishi				BMW				Citroen			
29,962 0.6				85,254 5.4				140,625 11.2				13,519 1.5			
Ford				Daihatsu				Total Peugeot group				Total Peugeot group			
2,436,247 46.5				32,631 2.1				75,993 6.0				53,183 5.5			
Total market				Fuji (Subaru)				Total Peugeot group				Jaguar/Daimler			
5,231,627 100.00				39,225 2.5				50,988 4.0				4,161 0.4			
				Suzuki				Renault							
				38,187 2.4				43,183 3.4							
				Kia				Toyota							
				29,350 1.9				32,120 2.6							
								Mazda							
								36,239 2.9							

## Customers in the US re-discover the 'cheapie'

By Kenneth Gooding, Motor Industry Correspondent

THE SUCCESS of Hyundai, the South Korean car maker, in the US this year is remarkable, even by the standards of the volatile American market. US customers re-discovered cheap new cars and helped Hyundai take nearly 1 per cent of their market in the first six months. Thus the company is well on the way to its target of selling 100,000 cars in its first full year in the States.

By the end of June Hyundai had sold more than 52,000 of the small, front-wheel-drive Excel models which in basic form have a list price of 4,995 compared with the average \$12,000 Americans pay for a new car or the average \$5,400 for a used car.

Hyundai's timing was fortuitous. The Japanese car makers who once dominated the cheaper end have been moving up-market now they can no longer look for big volume growth in the US.

When Hyundai announced last year it would launch in the US this year, one new car dealer in every 10 applied for the franchise.

Dealers had in mind the fortunes made by some colleagues who got in on the ground floor when the Japanese groups first started tackling the US car market. They also knew about Hyundai's phenomenal success in Canada where it was able to take advantage of the restric-

tions on Japanese cars to become the leading importer in the short space of about 18 months.

All this interest enabled Hyundai to put together very quickly a formidable dealer network.

The Japanese were not left completely out in the cold by the emergence of the demand for really cheap new cars in the US. To start with, Mitsubishi owned 15 per cent of Hyundai and supplies the Korean company with a great deal of technology under licence.

Mitsubishi also intends to sell version of the Excel through its own dealers in the States.

General Motors, which dominates the US market by importing small cars from its Japanese associates, Isuzu and Suzuki, and selling them at rock-bottom prices through its Chevrolet dealer network as the Spectrum and Sprint.

In the first half of this year GM sold 49,700 Isuzu-built Spectras, up from 29,000 in the same months of 1985 and 35,700 Suzuki-produced Sprints, up from 8,600.

By those standards, the other new "cheapie," the Yugo, launched with a base price of \$3,990 late last year by an independent importer from the state-owned Zastava company in Yugoslavia, had a relatively

modest first-half with sales of 11,940.

Some forecasters predict sales of cars with a price under \$6,000 could reach 1m a year in the US before long.

With this in mind, Chrysler has introduced Omni/Horizon America models at \$5,499 and GM is considering launching a version of its old Chevrolet Chevette at \$4,995.

GM has also lined up another South Korean import for 1988 which will be built by its Daewoo associate there and sold in the US with a Pontiac badge.

Not to be left out, Ford has bought 10 per cent of South Korea's Kia company for \$30m and intends to import into the US a Kia model to be sold as the Ford Festiva.

Meanwhile, the Japanese still make progress in the US. In the first half of this year sales of cars imported from Japan moved up from just over 1m in the same months of 1985 to about 1.1m.

However, the big three, Toyota, Nissan and Honda, gave up some volume to make way for those "captive" imports by GM from Isuzu and Suzuki, and for substantial increases by Mazda and Subaru.

When made-in-America cars are taken into account, Honda has been firmly established as the top-selling Japanese marque in the US and sells nearly twice as many cars in the States as in Japan.

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FRANCE				ITALY			
1985		1986		1985		1986	
Domestic	Imports	%	%	Domestic	Imports	%	%
594,535	65,225	11.3	11.3	599,679	69,440	11.6	11.6
5,231,627	100.00			5,231,627	100.00		
<b>DOMESTIC</b>				<b>DOMESTIC</b>			
Peugeot-Talbot				Fiat/Lancia/Autobianchi			
179,218 22.2				522,141 52.0			
Citroen				Alfa Romeo			
119,935 13.0				84,838 6.5			
Total Peugeot group				Renault			
316,145 35.2				104,425 10.5			
Renault				Volkswagen-Audi			
268,430 29.9				78,285 7.9			
				Ford			
				67,728 7.6			
				Fiat			
				42,977 4.7			
				General Motors-Opel			
				41,657 4.5			

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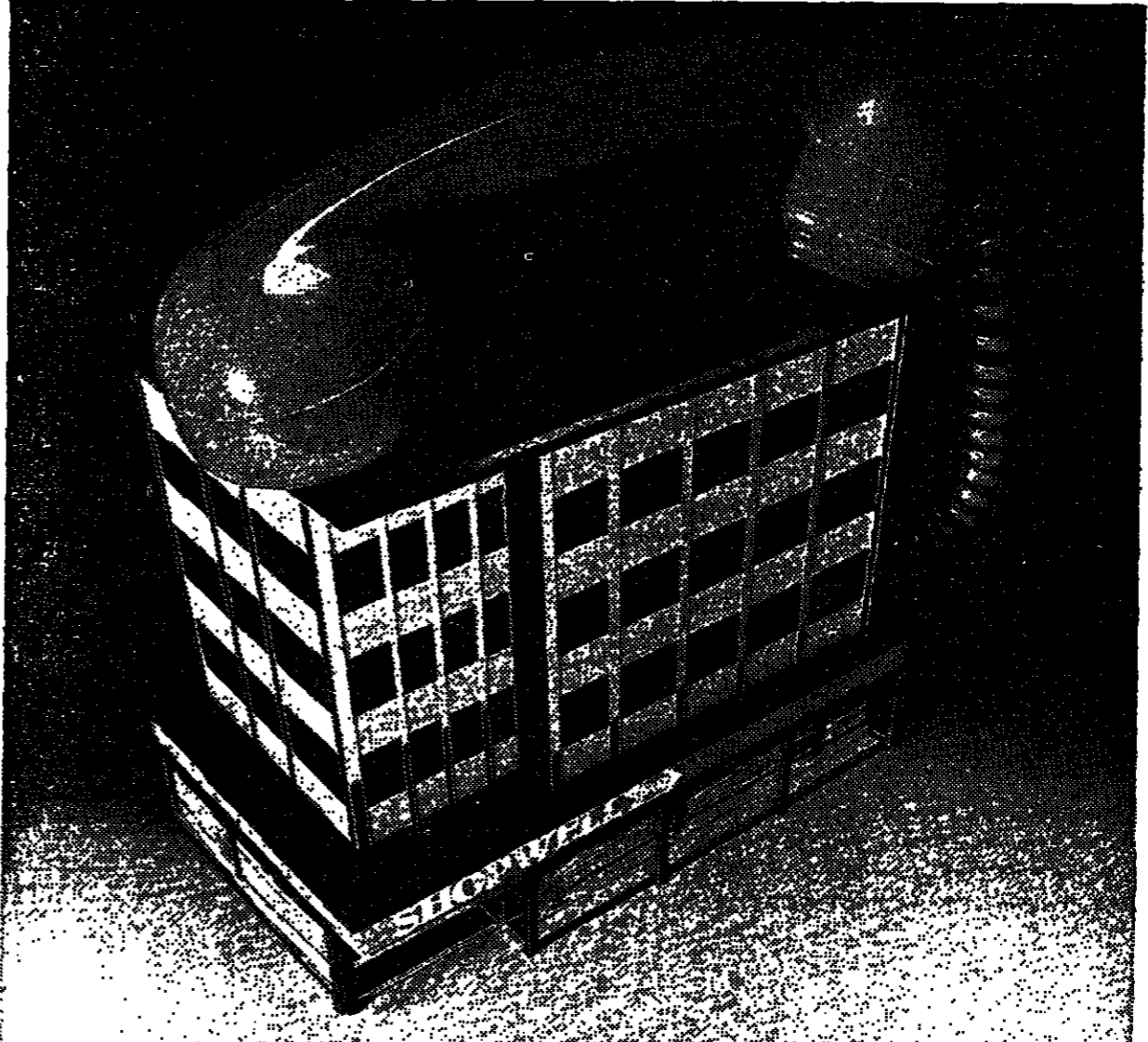
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# DIAL FREEPHONE GAS FOR THE FUEL OF THE FUTURE.



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Whether you're responsible for a corner shop or a chain of superstores, you can't afford to ignore the new developments in gas technology that will keep customers warm and fuel costs down. Gas is highly efficient, economical and will be still going strong in the 21st century and onwards.

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ENERGY IS OUR BUSINESS

### Notice of Redemption and Expiration of Conversion Rights to Holders of Miles International Inc.

**Miles International Inc.**  
4 3/4% Subordinated Guaranteed Convertible Debentures Due 1993  
(Guaranteed by Miles Laboratories, Inc.)

YOU ARE HEREBY NOTIFIED, pursuant to Section 4.04 of the Indenture dated as of June 15, 1968 (the "Indenture"), among Miles International Inc., a Delaware corporation ("Miles International"), Miles Laboratories, Inc., a Delaware corporation (successor by merger to Miles Laboratories, Inc., an Indiana corporation) ("Miles") and Citibank, N.A. (under its former name First National City Bank, as trustee (the "Trustee"), providing for the issue of the above-described Debentures (the "Debentures"), as amended and supplemented by the provisions of the First Supplemental Indenture dated as of January 8, 1979 (the "Supplemental Indenture"), among Miles International, Miles (under its former name Rhinchem Laboratories, Inc.) and the Trustee, that Miles International has called all of the Debentures for redemption on October 1, 1986 (the "Redemption Date"). The Debentures will be redeemed at 100.25% of the principal amount thereof plus accrued interest to the Redemption Date (the "Redemption Price") aggregating a total of U.S. \$1,016.35 for each U.S. \$1,000 principal amount of Debentures redeemed.

The Debentures will become due and payable and, upon presentation and surrender thereof (with all coupons appertaining thereto maturing after October 1, 1986), will be paid at the Redemption Price on the Redemption Date, at the option of the holder, (a) at Citibank, N.A., Bond Redemption Department, 5th Floor, 111 Wall Street, New York, New York 10043, or (b) subject to applicable laws and regulations, at the main offices of the Trustee in London (City Office), Brussels, Paris, Amsterdam, Frankfurt/Main and Milan or the main office of Banque Generale du Luxembourg, S.A. to Luxembourg. Payments at the offices referred to in (b) above shall be made by a check drawn on a bank in New York City or by transfer to a dollar account maintained by the payee with a bank in New York City. On and after the Redemption Date interest on the Debentures will cease to accrue.

As an alternative, pursuant to the provisions of Section 3 of the Supplemental Indenture, each U.S. \$1,000 principal amount of Debentures may be converted, at the option of the holder thereof, into the fixed amount of U.S. \$738.11 in cash (the "Conversion Price") by delivery of the Debentures (with all coupons appertaining thereto maturing after October 1, 1986) to any of the above offices, accompanied by written notice that the holder thereof elects to convert the Debentures. As promptly as practicable after the receipt of such notice and such delivery of such Debentures and coupons, there shall be delivered at said office to such holder, or on his written order, a cash payment as specified above. At the close of business on the Redemption Date such conversion rights will terminate.

Holders of Debentures should note that the Redemption Price is larger than the Conversion Price.

August 19, 1986

Miles International Inc.

**NOTICE**

Any payment made upon the redemption or conversion of the Debentures in the United States or by transfer to a dollar account maintained by the payee with a bank in New York City may be subject to reporting to the United States Internal Revenue Service (IRS) and to backup withholding at a rate of 20% if payee is not recognized as exempt recipient or if the payee fails to provide the paying agent with an executed IRS Form W-8, certifying under penalties of perjury that the payee is not a United States person or an executed IRS Form W-9, certifying under penalties of perjury that the payee's taxpayer identification number (employer identification number or social security number, as appropriate). Those holders who are required to provide their correct taxpayer identification number on Internal Revenue Service Form W-9 and who fail to do so may also be subject to a penalty of \$50. Please therefore provide the appropriate certification when presenting your Debentures for redemption or conversion.

UK NEWS

Joan Gray reports on one aspect of the City revolution  
Big Bang boom for builders

FROM a road junction close to the Financial Times' offices in the City of London, it is possible to see six office blocks covered with scaffolding; behind rise three tower cranes on the site that will be the Royal Bank of Canada's new offices; nearby, the second largest tower crane in Europe is at work on the stock exchange.

The space over and around Liverpool Street Station is already being transformed into a financial centre in a £300m scheme which is the largest building project in the City since the rebuilding which followed the Great Fire of London in 1666.

Just how well they are doing can be seen from a survey of the most important office building projects in the City carried out by the trade magazine Construction News.

comes directly from contracts linked to the Big Bang. One Arup's workload in the Square Mile has risen from 40 projects with a value of £50m last year to 69 projects worth £100m this year.

Aid sought for black S. African school plan

BRITISH industrialists with interests in South Africa are seeking support for a scheme to provide education in British, German and US universities for about 3,000 South African blacks and coloureds.

NOTICE OF REDEMPTION

To the Holders of R. J. REYNOLDS OVERSEAS FINANCE CO. N.V.

12 3/4% Guaranteed Notes, Due October 1, 1989

Unconditionally Guaranteed by RJR Nabisco, Inc. (formerly R. J. Reynolds Industries, Inc.)

NOTICE IS HEREBY GIVEN that, pursuant to the provisions of Paragraph 6 of the Fiscal Agency Agreement dated as of September 23, 1982, among R. J. Reynolds Overseas Finance Co. N.V. (the "Company"), as Issuer, RJR Nabisco, Inc., as Guarantor, and Morgan Guaranty Trust Company of New York, as Fiscal Agent, all of the Company's 12 3/4% Guaranteed Notes, Due October 1, 1989 (the "Notes") presents outstanding will be redeemed on October 1, 1986 ("the Redemption Date") at a redemption price (the "Redemption Price") of 101% of the principal amount thereof.

NOTICE OF REDEMPTION

To the Holders of COCA-COLA INTERNATIONAL FINANCE N.V.

11 3/4% Guaranteed Notes due 1989

NOTICE IS HEREBY GIVEN to the holders of the outstanding 11 3/4% Guaranteed Notes due 1989 of Coca-Cola International Finance N.V. (the "Company") that, pursuant to the provisions of Section 6 of the Fiscal and Paying Agency Agreement dated as of October 1, 1982 among the Company, The Coca-Cola Company (the "Guarantor"), and Morgan Guaranty Trust Company of New York (the "Fiscal Agent") and Paragraph 5 of the Terms and Conditions of the Notes, the Company has elected to redeem on October 1, 1986 all of its outstanding Notes at a redemption price of 101.5% of the principal amount thereof plus accrued interest to the redemption date.

FT COMMERCIAL LAW REPORTS

Digest of cases reported in the Trinity Term

In re A. V. Sarge & Co Ltd (FT, July 24)  
In December 1982, the company appointed Mr Ashworth its voluntary liquidator. He was displaced some 16 months later by a compulsory winding-up order amid allegations that he had dissipated the company's assets.

In re John T. Rhodes Ltd (FT, July 25)  
After the winding-up of the company, the liquidator, who needed to clarify many outstanding matters, obtained an order under section 268 of the Companies Act 1948 to examine an oath a former de facto director, Mr Hayward.

Appeal awarded the buyers \$45,853 demurrage. In allowing the sellers' appeal, Justice Staughton stated that "time to count as per Centrocon charterparty" referred to all provisions as to when time should and should not count, including clause 30 which was the material clause.

In 1971, while laying ducts for the Post Office, contractors damaged two underground cables belonging to the plaintiff. The damage was made good in 1978. A writ was issued in 1978 pursuant to section 26 of the Public Utilities Act 1950 that compensation was payable "equal to expense, reasonably incurred."

By giving the majority shareholders the statutory power to remove the minority shareholder as director and entitling them to buy his shares at fair value, the petitioner, who made no attempt to use the machinery in determining the fair value of his shareholding, should not be entitled to complain of unfair conduct in the circumstances and his petition should be struck out.

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NOTICE OF EARLY REDEMPTION

ORIENT LEASING CO., LTD.

US\$50,000,000 5 1/4% Convertible Bonds 1998 ("BONDS")

Notice is hereby given that in accordance with Condition (B) of the Terms and Conditions of the Bonds, the Company will redeem all of the outstanding Bonds at 104% per cent of their principal amount on September 26, 1986 when interest on the Bonds will cease to accrue.

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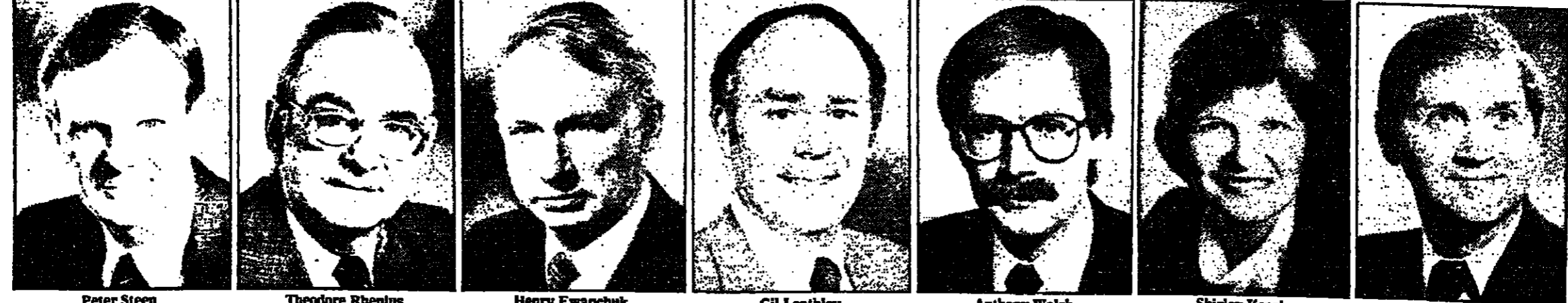
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ADVERTISEMENT

The International Corona Group of Companies



Peter Steen, Theodore Rhenius, Henry Ewanchuk, Gil Leathley, Anthony Walsh, Shirley Kozel, Hans Pump

Peter Steen, Chairman, President and Chief Executive Officer of International Corona Resources Ltd., and Royex Gold Mining Corporation; Chairman of the Board of Mascot Gold Mines Limited, is pleased to announce the appointment of Gil Leathley as Senior Vice-President, Operations of International Corona Resources Ltd. and Royex Gold Mining Corporation.

Mr. Leathley will join the existing Corona Group Management Team which also includes: Theodore E. Rhenius, Senior Vice-President and Chief Financial Officer of International Corona Resources Ltd.; Royex Gold Mining

Corporation; Mascot Gold Mines Limited. Henry Ewanchuk, President and Chief Executive Officer of Mascot Gold Mines Limited; Senior Vice-President, Exploration of International Corona Resources Ltd.; Royex Gold Mining Corporation. Anthony P. Walsh, Corporate Controller of International Corona Resources Ltd.; Royex Gold Mining Corporation. Shirley A. Kozel, Corporate Secretary of International Corona Resources Ltd.; Royex Gold Mining Corporation; Mascot Gold Mines Limited. Hans Pump, Controller-Operations of International Corona Resources

Ltd.; Royex Gold Mining Corporation. International Corona, an independent gold mining company with substantial interests in the Hemlo area, is also the largest shareholder in Royex Gold Mining Corporation, a public company engaged in the exploration, development and management of gold properties in North America. Royex is the largest shareholder of International Corona, with a controlling interest in Mascot Gold Mines Limited. It also owns 50% of and manages the Renabie Gold Mine joint venture. Mascot is currently developing a major gold mine near Hedley, B.C., and is the exploration arm of the International Corona Group.

UK NEWS

# Tin brokers say ITC members acted unlawfully

BY ANDREW GOWERS

A GROUP of 11 London Metal Exchange brokers has formally accused the 22 member governments of the International Tin Council (ITC) of acting unlawfully and irresponsibly in the events surrounding the tin crisis.

The brokers have grouped together under the name of Tinco Realisations to attempt to recover losses totalling about £400m which they sustained when the tin market collapsed in March. They made their claims in a briefing document published at the weekend and circulated to trade ministers of the ITC member countries, including Britain.

The release of the document marks the latest attempt by Tinco Realisations to put public pressure on ITC members to admit liability for the council's debts on which it effectively defaulted when its price support operation in the tin market collapsed last October.

The brokers clearly remain anxious to reach an out-of-court settlement if possible, though they reiterate in the new document that they have received "the strongest legal advice concerning the culpability and liability of the member states, and it is difficult to imagine the member states receiving contrary advice."

# Thatcher to visit Moscow next year

MRS MARGARET Thatcher, the Prime Minister, has formally accepted an invitation to visit Moscow next year for talks with Mr Mikhail Gorbachev, the Soviet leader, Michael Cresswell writes.

The visit, first suggested during the recent trip to Britain by Mr Edward Shevardnadze, the Soviet Foreign Minister, will be Mrs Thatcher's first working visit to Moscow. She attended the funeral last year of Mr Konstantin Chernenko, the former Soviet leader.

Mrs Thatcher has written to Mr Gorbachev, suggesting that the two leaders fix a date for some time during 1987.

The timing of the visit will inevitably give rise to speculation about the date of the next general election in Britain, given the potential electoral boost for any prime minister undertaking such a top-level mission.

JOHN BROWN Engineers has teamed up with Aker Engineering of Norway to set up joint companies to handle the management, design and engineering of offshore projects.

Initially, the companies will work in the UK and Norway, but the agreement is aimed at leading the way to broader co-operation in the international offshore market.

John Brown, part of Trafalgar House, will hold 55 per cent of a London-based company, John Brown-Aker, and Aker will own the rest. In Oslo, the holdings will be reversed in the other company, Aker-John Brown.

THE LABOUR Party is considering the creation of a new tier of regional councils as part of proposals for restructuring local government in England and Wales.

The plan, aimed at streamlining the present system of local government and improving democratic control at regional level, could involve the abolition of the 47 existing county councils and their replacement by up to 12 regional authorities.

HORIZON TRAVEL, Britain's third biggest tour operator, made a further attack in the holiday price war with the publication of revised winter brochures.

Some skiing holidays have been reduced by up to £50 with price cuts of up to £71 and the addition of an extra 20,000

# Cereals harvest expected to be good in both yield and quality

BY JOHN CHERRINGTON

THE BRITISH cereals harvest has started slowly this year, but most farmers have been surprised by the yield and quality of the crops. Some believe it could be a vintage year for grain.

Most fields of wheat, in particular, appear to be of a very high standard, according to an informal survey at the weekend.

The quality of the crops is good, considering that autumn-sown fields of wheat, barley and oilseed rape suffered badly from poor weather in winter and late spring. Many were then thought to need re-seeding.

Wheat has recovered well in many parts of the country from ear-

ly thinning. Oilseed rape yields are reported to be a good average. Spring-sown barley has been yielding very well.

The only disappointing reports have come from farmers growing autumn-sown barley, where yields have been unremarkable.

But three quarters of the crop is still in the fields being battered by poor weather, and losses of both yield and quality could yet be substantial.

The Home-Grown Cereals Authority said earlier this year that, if yields were as high as in the bumper year of 1984, the 1986 harvest - particularly of wheat - could set a record. Wheat plantings have risen

by 4.6 per cent this year to 1.99m hectares.

The 1984 UK grain harvest totalled 28.5m tonnes while last year production fell to 22.47m tonnes.

If there is another large British harvest, it will add to the already bulging stores of surplus grain. Heavy supplies may also diminish the premiums which might otherwise be earned by quality milling wheats, and the official intervention stores may turn out to be the destination of much of this grain.

But for some cereals, demand - particularly for export - is healthy owing to drought elsewhere in the European Community.

# Foden competes for army deal

BY KENNETH GOODING, MOTOR INDUSTRY CORRESPONDENT

FODEN, the subsidiary of Paccar of the US, is waiting for an announcement about a contract from the Ministry of Defence for 2,000 heavy trucks worth about £250m.

Foden is one of the two front runners in the race for the contract. The other is Scammell, the specialist vehicle producer within the state-owned Rover group (formerly BL).

Both companies would use Rolls-Royce 350 diesel engines, now produced in Britain by Perkins, owned by Vauxhall Corporation (formerly Massey Ferguson) of Canada.

Mr Mark Pigott, managing director of Foden, says he expects the

ministry to make up its mind before the end of this year. Some observers believe the contract will be split between the two contenders. Mr Pigott admits that that is a possibility, but says he has had no indication of the outcome.

The companies have been asked to tender to provide vehicles for the British Army's Drops (Demountable, rack, off-loading and pick-up system) to meet the requirement for faster supply of ammunition between depot and front line.

Drops vehicles not only will be able to cover all types of terrain at relatively high speed but can also load and unload tons of ammunition

in under one minute. The army will want the 2,000 trucks supplied over five years, starting in 1988 or 1989.

Foden, which employs 450 people, produced about 550 heavy trucks (over 24 tonnes gross weight) last year, as well as about 100 military vehicles. In 1986, output of non-military vehicles should rise to about 700.

Mr Pigott says that Foden is operating profitably. The most recently filed accounts for Paccar UK, the major asset of which is Foden, show that in 1984 it suffered a net loss (after tax) of £553,000, down from a loss of £1.43m the previous year.

# TSB to announce flotation timetable

BY DAVID LASCELLES, BANKING CORRESPONDENT

THE EXACT timetable for the flotation of the Trustee Savings Bank is to be announced tomorrow with the release of the pathfinder prospectus by Lazard Brothers, the bank's merchant bank advisors.

The document will also pave the way for the UK's largest issue of bank shares by giving detailed financial information about the TSB and making a forecast of the group's profits for its current financial year.

One crucial piece of information will be missing - the price of the issue which will not be decided until "impact day" after which there will be about 10 days for investors to

lodge their applications for shares.

The issue, due for mid-September, is expected to raise in excess of £1bn for the Trustee Savings Bank. Lazard have been working on assumptions ranging as high as £1.65bn, though a more likely range is thought by the City of London to be £1.2bn-£1.4bn.

The key factors in the pricing will be the levels at which other bank stocks are selling and the yields available on them. If the TSB's shares are priced at seven times its expected earnings of about £185m this year - a ratio in line with the other big clearing banks - the issue would yield a total of £1.3bn.

From these figures, however, will have to be deducted about £170m to cover issue costs and account for shares being handed out free to employees or earmarked for a special loyalty fund to reward shareholders who keep their shares for three years after the flotation.

Many of Lazard's calculations are also based on the assumption that the dividend will yield about 5.5 per cent, again broadly in line with the clearers. Because the TSB will be seeking many private shareholders who are accustomed to keeping their money in building societies, it will probably emphasise the yield as a familiar measure.

# Petrol prices likely to rise by 7p a gallon

BY LUCY KELLAWAY

OIL COMPANIES are preparing for another round of petrol price rises which is expected to raise pump prices by about 7p to a typical charge of 170p or more a gallon.

The move, which is expected within the next week, is likely to go ahead despite the criticism which accompanied the last rise, announced earlier this month.

The second rise is likely to be blamed on the recent increase in crude oil prices. Oil companies said that the 7p increase announced two weeks ago took no account of higher crude oil prices, but was a much needed correction to the steady ero-

sion of petrol prices in the past few months.

At an average price of 157p a gallon, oil companies claimed that they were making little, if any, profit from selling petrol.

At the time of the first rise, BP gave a warning that another increase in petrol prices would be necessary by the end of the month to reflect higher crude prices. In the last four weeks crude oil has risen from about \$10 a barrel to about \$14, although it is still only half the level at the start of the year.

Editorial comment, Page 12; Lombard Page 13

## ISSUES OF GOVERNMENT STOCK

THIS NOTICE DOES NOT CONSTITUTE AN OFFER FOR SALE AND THE STOCKS LISTED ARE NOT AVAILABLE FOR PURCHASE DIRECT FROM THE BANK OF ENGLAND.

The Bank of England announces that Her Majesty's Treasury has created on 22nd August 1986, and has issued to the Bank, additional amounts as indicated of each of the following Stocks:

- £200 million 11 per cent EXCHEQUER LOAN, 1990
- £150 million 10 per cent CONVERSION STOCK, 1996
- £150 million 8 1/2 per cent TREASURY STOCK, 2002

The price paid by the Bank on issue was in each case the middle market closing price of the relevant Stock on 22nd August 1986 as certified by the Government Broker.

In addition, Her Majesty's Treasury has created on 22nd August 1986, and has issued to the National Debt Commissioners for public funds under their management, additional amounts as indicated of each of the following Stocks:

- £100 million 11 per cent EXCHEQUER STOCK, 1989
- £100 million 10 1/2 per cent EXCHEQUER STOCK, 1987

In each case, the amount issued on 22nd August 1986 represents a further tranche of the relevant Stock, ranking in all respects pari passu with that Stock and subject to the terms and conditions applicable to that Stock, and subject also to the provision contained in the final paragraph of this notice; the current provisions for Capital Gains Tax are described below.

Application has been made to the Council of the Stock Exchange for each further tranche of stock to be admitted to the Official List.

Copies of the prospectuses for 11 per cent Exchequer Loan, 1990 dated 8th February 1986, 10 1/2 per cent Exchequer Convertible Stock, 1989 dated 22nd November 1985 (which contained the terms of issue of 10 per cent Conversion Stock, 1988) and 8 1/2 per cent Treasury Stock, 2002 dated 12th August 1985 may be obtained at the Bank of England, New Issues, Watling Street, London, EC4M 9AA.

The Stocks are repayable at par, and interest is payable half-yearly, on the dates shown below.

Stock	Redemption date	Interest payment dates
11 per cent Exchequer Loan, 1990	12th February 1990	12th February 12th August
10 per cent Conversion Stock, 1996	15th November 1996	15th May 15th November
8 1/2 per cent Treasury Stock, 2002	27th August 2002	27th February 27th August

The further tranches of 11 per cent Exchequer Loan, 1990 and 10 per cent Conversion Stock, 1996 will rank for a full six months' interest on 12th February 1986 and 15th November 1985 respectively. The further tranches of 8 1/2 per cent Treasury Stock, 2002 has been issued on an ex-dividend basis and will not rank for the interest payment due on 27th August 1986 on the existing Stock. Official dealings in the Stocks on the Stock Exchange are expected to commence on Tuesday, 26th August 1986.

Each of the Stocks referred to in this notice is specified under paragraph 1 of Schedule 2 to the Capital Gains Tax Act 1979 as a gilt-edged security under current legislation exempt from tax on capital gains, irrespective of the period for which the Stock is held.

Government statement  
Attention is drawn to the statement issued by Her Majesty's Treasury on 29th May 1985 which explained that, in the interest of the orderly conduct of fiscal policy, neither Her Majesty's Government nor the Bank of England or their respective servants or agents undertake to disclose tax changes decided on but not yet announced, even where they may specifically affect the terms on which, or the conditions under which, these further tranches of stock are issued or sold by or on behalf of the Government or the Bank; that no responsibility can therefore be accepted for any omission to make such disclosure; and that such omission shall neither render any transaction liable to be set aside nor give rise to any claim for compensation.

BANK OF ENGLAND  
LONDON  
22nd August 1986

## THE FINANCIAL TIMES

is proposing to publish a survey on  
**EMPLOYEE WELFARE**  
Friday, September 19, 1986

For further information please contact:  
MARK FISHER  
on 01-245 8000 ext 3389

**FINANCIAL TIMES**  
EUROPE'S BUSINESS NEWSPAPER

**A BANK WHICH SPANS THE LENGTH AND BREADTH OF THE WORLD'S MOST DYNAMIC REGION.**

The Pacific basin. Today, the arena for over half the world's trade. And today as for many years, home ground for Standard Chartered Bank. Standard Chartered has built a presence throughout the Far East which remains unrivalled today. While Union Bank, now a leading business bank in California, represents a successful US acquisition by a British bank. The result is a geographical spread - of over 250 branches in the Pacific basin - which is now the envy of many banks scrambling for footholds in the region. It is a powerful example of the way that Standard Chartered's management strengths have built an international network, of more than two thousand offices in over sixty countries. A network which is highly-integrated, built on common procedures and information systems: but made up chiefly of offices which play a central and established role in their domestic markets. And thus, a network ready to serve the needs of international business, of local business and of private individuals. To find out more, contact your nearest branch.

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MANAGEMENT: Small Business

Technology start-up

IPS heralds a new scale of risk funding

BY WILLIAM DAWKINS

WERE IT not for the persistent icy drizzle, visitors to Integrated Power Semiconductors' blue steel and glass factory might be forgiven for thinking they were in California...

consortium of 18 institutions. Keeping that group fully informed has been a significant burden for IPS.

Smartpower

It comes as no surprise that Wood, appropriately a Californian, met extreme difficulty in persuading the City to back his plan for the first significant UK semiconductor maker since the birth of the troubled Immos in 1978.

Semiconductor makers have traditionally tended to serve one of two markets: devices for controlling the power that goes into circuits, or the circuits themselves.

computer businesses, though its devices can be used in many other products, where mechanical parts are controlled electronically.

But why Britain? "I wanted to serve the European as well as the US market and you can't easily serve Europe from America," argues Wood.



Livingston (Scotland) and Denver (Colorado) sites of IPS

55m round was in place and IPS was able to start marketing semiconductors made under contract by Motorola in France.

By round three—£2m in June—the semiconductor industry's depression had stubbornly refused to end, but Wood and his team could ill afford to spend days pleading their case in the City all over again.

Second round

However, the recession in the semiconductor industry has meant that prices for second source products have dipped by up to 20 per cent since Wood drew up his plan.

In brief...

A NEW source of help for first time microcomputer users in trouble emerged last week with the launch of the newly formed Small Business Support Group.

Based in Broadway, Worcestershire, the group consists of six microcomputer software experts who aim to provide instant telephone assistance for buyers of most makes of microcomputers.

By round three—£2m in June—the semiconductor industry's depression had stubbornly refused to end, but Wood and his team could ill afford to spend days pleading their case in the City all over again.

Accordingly, they took a risk and simply asked existing shareholders to put up the cash through a rights issue.

There is no reason that we cannot do £100m sales by 1991. We know the market exists and we have the technology," Wood says bravely.

YORK ENTERPRISE, the city's enterprise agency has launched a £250,000 business development fund for small ventures likely to create or sustain jobs in the area.

How to assess a market

Martin Posner continues his series on exporting

THE NEXT step for a business that has decided to explore the possibilities of exporting is to assess the market for that first overseas order.

A report will normally be provided within 15 weeks, from the first enquiry to the Market Prospects Service. Its first part will cover topics like market conditions, local demand and the strengths and patterns of competition from locally produced and imported goods.

A good start is to look at the detailed statistics of the Export to Europe Branch of the British Overseas Trade Board.

The second part of the report is an assessment of the product or service's chances in the existing market. It gives an overview of likely competitiveness in terms of price, delivery and quality.

This information is free to all businesses. Further sources are the country reports issued by all major clearing banks.

This market prospect service costs only £175 (including VAT). It is a greatly subsidised scheme available to exporters who wish to develop sales in Western Europe.

A quick read of the Bankers' Almanac Year Book, which is available in most reference libraries, will show how many international banks operate from the City of London.

Free professional advice is also available from the board on how to get about market research for goods or services produced in the UK.

Reading this general background material will help the first-time exporter to develop a feeling for the target country.

The World Trade Intelligence publishes guides from £19.50 each for exporters considering the following markets: West Germany, Netherlands, France, Italy, Spain and Portugal.

It is now possible to start assessing the market for the product or service to be exported. The BOTB also operates a Market Prospect Service through which it can contact the 170 British embassies and consulates abroad.

Once the budding exporter has given a description of his company and its goods or services, copies of trade literature and, if possible, a product sample, the commercial attache's office will then make specific enquiries to assess the prospects.

Business Opportunities

READERS ARE RECOMMENDED TO TAKE APPROPRIATE PROFESSIONAL ADVICE BEFORE ENTERING INTO COMMITMENTS

An Exciting Investment Opportunity In Tourism Malaysia & Singapore. THE PRINCE, THE FERRINGHI, FEDERAL HOTEL. All Enquiries To MR. BILL CROSS At The Sole Agents COLLIERS International Property Consultants

CORPORATE PARTNER SOUGHT. Small UK based Biotechnology company. Range of innovative medical products.

BELOW THE LINE. Profitable promotions company with excellent product line.

ATTENTION LESSORS. Expanding motor dealer dealing in small units.

PUBLIC COMPANY wishing to expand and diversify seeks to acquire Companies serving INDUSTRIAL AND SPECIALIST ENGINEERING MARKETS.

WE ARE LONDON'S LARGEST WHOLESALE SUPPLYING TO THE CHEMIST TRADE. For over 20 years with 1,000 plus live accounts.

BUILDING & DEVELOPMENT COMPANY (KENT). With £600,000 profit projected this year and better to follow.

FAX UPDATE. WHOLESALE SPECIALS OF PHASE THREE FAX MACHINES. Also Portable Fax Machines.

AN AUSTRALIAN COMPANY specialising in the manufacture of a high quality range of abrasives.

RETIRED FINANCIAL DIRECTOR (early forties) of multinational PLC with 25 years experience.

BUSINESS CAPITAL. Equally experienced UK/EEC businessmen seeking expansion capital or acquisition financing.

Business Services. LOOKING FOR MORTGAGE FINANCE? Commercial/Industrial/residential properties.

Offshore & UK Companies. Incorporation and management in UK, Isle of Man, Channel Islands, Hong Kong.

Office Equipment. IBM Model 1287 OGR. Numerous features. End of lease offers invited.

SHOPFITTING. A successful public company seeks to acquire a shopfitting contracting business.

PROPERTY COMPANIES WANTED. My client which is a listed company wishes to acquire property and development companies.

MAJOR FIRM. Involved in Insurance Broking, Life & Fire Insurance, Investment Services.

COMPANY WANTED. A profitable property company anticipating profits of at least £1 million wishes to acquire a company with trading losses or excess management charges.

Businesses for Sale. Metallic Abrasive Manufacturer. Comprehensive range of abrasives and steel powder products.

Old Established Quality Manufacturing Silversmiths. FOR SALE AS A GOING CONCERN. Turnover £1.2m.

FOR SALE CLEVELAND AN ESTABLISHED SUCCESSFUL CARPET RETAIL COMPANY. With a turnover in excess of £2 million.

ENGINEERING BUSINESS. Long established business with an excellent spread of products.

FOR SALE—or INVESTMENT D. I. Y. MARKET LEADER. Turnover c. £600,000 and increasing.

Ca'shhhh! It's the confidential Factor. Would you like to turn your invoices into cash without anyone knowing? Now you can. For just a 'phone call you could have an advance of 80% on invoice.

Confidential Invoice Discounting. To: Confidential Invoice Discounting Limited, P.O. Box 240, Sovereign House, Queen's Road, Brighton BN1 3WX.



APPOINTMENTS

Alex. Stenhouse creates new division

ALEXANDER STENHOUSE has formed an aviation and aerospace division. The new division has been specially created to handle the exclusive purpose of providing London marketing services for the US and Canadian aviation operations of Alexander & Alexander Inc and Stenhouse, as well as for international space and satellite interests. Appointed as divisional directors are Mr A. H. Elson, R. D. J. Woods, Mr E. A. Webb and Mr K. H. Coombe.

CONTRACTS

£15m radar order for Marconi

MARCONI RADAR SYSTEMS has been awarded a contract worth £15m by the Royal Air Force to supply defence radars and to modernise radar facilities in the kingdom of Jordan. The contract follows the Memorandum of Understanding for the £247m Jordan defence package signed during the visit of Mr Margaret Thatcher to Jordan in last September. A significant element of the current project is the purchase of equipment Marconi radar has supplied over a period of 25 years.

FEDERATION to succeed Mr Donald Anderson who has taken up a senior position with Courtauld. At I. G. LINTELS Mr Wayne Palmer has become a financial director and company secretary. Mr Pulman who joined I. G. Lintels in August 1985 as financial manager and company secretary will now be in overall control of the company's financial affairs. Mr Stephen Finch has been made a director and deputy chairman of NOBLE & LUND. He was previously deputy chairman of Weir Group and a director of Suter.

DELTA GROUP has won orders worth over £5m to supply the Hong Kong construction industry with electrical equipment. The most recent, worth over £500,000, is for the supply of switchgear for the new Lantau Parkview Development—a £100m, 1,000 apartment project being built by Trivium. Other orders that Delta are currently handling include: the supply of cables and electrical switchgear to the Swire Group's Tai Koo Shing development of 7,000 residential apartments; the outfitting for the Hong Kong and Shanghai Bank new headquarters and contracts to supply the Government of Hong Kong with cabling and switchgear for its 35,000 houses-per-year low cost housing programme and the construction of the new Tseung Maen Hospital.

Liberty Life Association of Africa Limited

Interim report for the six months ended 30 June 1986

Table with 4 columns: Item, 6 months ended 30 June 1986, 6 months ended 30 June 1985, % change, and 31 December 1985. Rows include: Net premium income, Net income from investments and annuity income, Total income, Net fund surplus, and various ratios.

Notes: 1. Life insurance operations. Due to the general responsibility of underwriting full actuarial valuations other than at the end of the financial year, no valuations of the life funds of Liberty Life and its subsidiary, Charter Life Insurance Company Limited, are conducted at the half-year stage. 2. Issued share capital. 21 Rights offer. In April 1986 the company raised £246.6 million by way of a rights offer of 2,467,000 new ordinary shares to the holders of its ordinary and convertible preference shares.

3. Interim ordinary dividend. In accordance with the company's dividend policy of declaring interim ordinary dividends at a level of one-half of the total ordinary dividend for the immediately preceding financial year, the directors have resolved to declare an interim ordinary dividend of 150 cents per ordinary share in respect of the year ending 31 December 1986. 4. New business. During the 6 months ended 30 June 1986 new annualised premiums (which exclude single premiums and annual considerations of £7.1 million were virtually identical to the £77.4 million achieved during the corresponding period of 1985 notwithstanding the difficult economic conditions prevailing during the period under review.

Businesses for Sale

FARMER ROPER LIMITED. The Joint Receivers offer for sale the business and assets of a well established industry leader in the manufacture and installation of melting plant for foundries and pollution control equipment. Located in Keighley, W. Yorkshire. Well equipped metal fabrication factory (freehold 18,500 sq ft).

ENGINEERING BUSINESS FOR MERGER. Long established engineering company involved in the installation, service, repair and refurbishment of specialised capital equipment plus regular sales of spare parts by potential to significantly improve its current profits by amalgamation with similar business.

PLASTIC COATINGS. Offers are invited for specialists which has been trading for 5 years and specialises in the coatings market for decorative and performance enhancement, enabling plastics to be scratch resistant and impervious to a wide variety of chemicals.

ENVIRONMENTAL CONTROL COMPANY FOR SALE. A chemical engineering company specialising in the design and supply of equipment to control air pollution from industrial processes.

Large Car Sales Showroom. Superb main road position in West Kent. Freehold property including large garage and 2,000 sq ft PA. Limited stock of cars.

ENGINEERING GROUP OF COMPANIES. Turnover £31 million, sound profit record. Market leader in the engineering industry.

For sale. Specialist Employment Agency and Hi-Tech Contract Inspection Company. Turnover £1,200,000 p.a. net profit £120,000.

VICTOR CASTINGS LIMITED. The Joint Receivers and Managers offer for sale the business and assets of Victor Castings Limited. Grey iron and malleable iron foundry. Annual turnover c. £650,000.

HOLDING COMPANY OFFERS SMALL ENGINEERING/MANUFACTURING COMPANY IN THE SW OF ENGLAND. For Sale or Participation by a U.K. Engineering firm of at least middle size.

HAULAGE/DISTRIBUTION COMPANY. Operating nationally and internationally from freehold depot in SE England. Turnover in excess of £13m.

Ceramic Tile and Bathroom Wholesalers. Central Scotland region. Very profitable business for sale.

ESTABLISHED TOWN CENTRE HOTEL. LOCATED ON A PRIME SITE IN A RAPIDLY EXPANDING EAST MIDLANDS CITY, WITH PROVEN MARKET. Planning consent for 80 beds, on a freehold site.

Horticultural Business. Plant propagation nursery specialising in modular production of vegetable plants for the farming industry. The business and assets are offered for sale on a going concern basis.

Stoy Hayward. By Order of R. W. Cook, Esq., FCA. re: Peter Wilton Components Ltd (in Liquidation). AUTO FACTORS. Modern Fully-Equipped Distribution Premises - Watford. 3,900 sq ft - Offices, Flat and extensive Warehouse Stocks of Commercial Vehicle parts at Cost £110,000.

Company Notices. THE RANDFONTEIN ESTATES GOLD MINING COMPANY, WITWATERSRAND, LIMITED. Incorporated in the Republic of South Africa. Registered No. 01/02581/06.

For Sale by the Receiver and Manager The Business and Assets of Kirk Holdings Limited BB Kirk (Constructions) Limited Kirk Developments Limited (in Receivership). building and civil engineering contractors. Turnover approximately £9.2m per annum.

Touche Ross. 11 Albion Street, Leeds LS1 5PJ. Telephone: 0532 44741. Telex: 556376 TRLEED G. Developers wish to dispose of SUBSTANTIAL DEVELOPMENT SITE with full Planning Permission in South Wales.

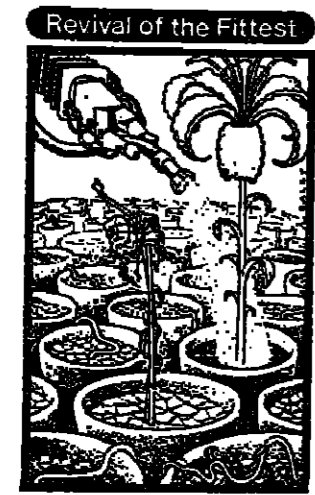
TECHNOLOGY

Peter Bruce in Bonn tracks the progress of Westphalia Separators, a leading separator maker

Where robots now stalk the factory floor



Cheese is just one dairy product which relies upon the separator for its manufacture



IT HAS become quite hazardous to walk about the main machining shop at Westphalia Separator's sprawling works in Oelde, a small town just north of the Dortmund-Hanover autobahn. For about two years now the floor has been the preserve of two brooding, computer-controlled workpiece transporters and they are not programmed to avoid visitors.

after 1945 the chemicals industries in Europe and the US began to make huge demands on separator producers. Separator technology and to adapt itself to very large capacities and to automation. Today about 60 per cent of Westphalia's revenue is earned in non-dairy markets.

vision by a foreman for about 30 minutes at the start of each day. The two Dixi 420 TPA machining centres replaced two Dixi job borers and two Scharmann CNC horizontal borers. Mr Habig insists that none of the other potential suppliers they looked at could guarantee them this accuracy.

do it stop inventing," says Mr Habig. If the intervention of politics was not the reason you bought it," he says. Having been to the machine tool shows and sized up the variables you are led to one decision - FMS.

chiefs weep if they fail to do that every 12 months) and net profits for last year totalled DM 12.4m. Although the FMS has already paid for itself, Mr Habig is also adamant that it is used to the full and the company has begun to examine ways of doing more with the machines.

Measuring finishes

PLASTICS and surfaces machined to mirror finishes may not be as smooth as they seem. So Hahn and Kolb has developed an optical sensor which can measure surface roughness without contact.

In optical sensing, a beam of infrared light is directed at the surface being checked. The beam is scattered according to the irregularities in the surface.

Image processing

IMAGE processing becomes markedly cheaper with a UK-developed system from Data Harvest of Bedford, which is making and selling a system for industrial, security, scientific and other fields that costs only £395.

Office planning

INTERGRAPH, one of the leading specialist makers of computer aided engineering, design and manufacturing systems has launched some software for planning the layout of an office of production.

Monitoring moving components

PANDROL International has launched a system which can measure the movement between neighbouring components. This has already been used in the railway industry to study the movement of the rail relative to the support sleeper which can indicate any likely faults in the railway line as vehicles travel over it.

The dielectric displacement measuring instrument, which was developed by Cambridge Consultants for Pandrol Industries, has a wide range of applications where two components move relative to one another. More information from Pandrol in London on 01-834 2255.

Hunting for particles

THE PRESENCE of particles in fluids causes damage to plant and machinery. Monitoring the amount of such particles in lubrication oil, for example can indicate that a machine will need repair or maintenance.

IBM PC acts as a telephone

PHONE TERMINALS are created from the IBM personal computer (PC) or a compatible model by plugging in a circuit board from Thora Electronics.

The PC becomes an integrated workstation for voice and data. For use with the Thora Electronics TD 110 voice/data FAX (company telephone exchange). Users continue to use their PCs as before, but in addition can communicate data to other users either in or out of office buildings. The board sets the appropriate data rates automatically.

Sun and wind power join forces

THE FIRST use of combined wind and sun power to heat homes in Britain was demonstrated last Friday at the opening of the Energy World exhibition at Milton Keynes.

It was one of more than 50 energy efficient homes which are on show over the next months and is probably the most unusual in terms of power generation.

At present only one house is powered by the combined system though nine houses are eventually planned for the site. Each house will have a bank of solar arrays set into the conservatory roof. The output of the arrays goes to a central control building where the power is distributed around the network.

The central control building also has a 37 square feet array on its roof.

The wind generator also links into this central grid. It has 30 feet diameter blades and is mounted on a 60 feet high tower at the Milton Keynes Energy Park. Total output of the two systems is 30KW.

Both wind and sun power on their own tend to fluctuate in their ability to supply electricity so the hope is that co-generation can better match the seasonal demands. The project will be monitored by the Open University.

The control room also contains 5 tonnes of back-up batteries to store electricity to provide extra power that may be needed.

The combined system not only provides electricity for heating, lighting and cooking but also powers a small fountain in the complex.

The 550,000 project has been funded 40 per cent by the Energy Directorate of the European Community and the Department of Trade and Industry in the UK has also promised to contribute to the cost.

Solapak, one of the leading electricity companies in the UK has built the arrays with IED, part of the NEL group, has built the wind generator and Powernetics has provided the controls.

DKB ECONOMIC REPORT August 1986: Vol. 15, No. 8

Japanese economy will grow 2.4% in fiscal year 1986

In 1986, the U.S. economy is expected to grow 2.5 per cent in real terms. Buoyed by declining oil prices, lower interest rates and a weaker dollar, U.S. business activity will advance moderately this autumn. Due to the huge surplus in Japan's current account balance, the yen will remain strong during the year. The yen will remain around 180 to the U.S. dollar in fiscal 1986. As for crude oil prices, Japan will import crude oil at about \$16 per barrel in the fiscal year.

causing brighter signs of recovery. Outlook for each demand segment Personal consumption will increase 3.0 per cent in real terms, higher than the 2.7 per cent for fiscal 1985. Although nominal personal income growth will slow down due to low pay hikes and less overtime work, real personal income will show a higher growth rate, helped by price stabilization.

Private housing investment is expected to increase 4.9 per cent in real terms, higher than in fiscal 1985. Housing starts will be promoted by lower materials prices, lower interest rates, tax cuts and softer housing loans. Private capital investment will not lose upward momentum, but its projected annual growth of 5.3 per cent will be far below the rate in fiscal 1985. Behind the slower growth are declining exports in the manufacturing sector. This sector will refrain from building up its facilities, reflecting lower capacity utilization and declining earnings.

With their off-year elections approaching, the U.S. is expected to step up criticism of the Japanese surplus. It seems unlikely that the strong yen alone will mitigate Japan's external economic friction. Cash, it is essential that Japan boost imports by opening its markets further to foreign goods and expanding domestic demand.

of the so-called J-curve effect. Although the mighty yen will help increase import volume, the value of dollar-based imports will be unchanged as a fall in oil prices will make oil imports cheaper.

Outlook for Japanese Economy in FY 1986. Table with columns for FY1986, FY1985, and Percent for FY1986. Rows include Real gross national expenditure, Domestic demand, Private domestic demand, etc.

work of the austerity budget policy, there will be limits on the use of effective fiscal policy. Therefore, stimulating private demand would be a key to sustained economic growth. Specifically, it will be necessary to pass on the benefits of the yen's rise and cheaper oil to the domestic economy as soon as possible and also to promote the demand-expansion measures proposed in the so-called Mayekawa report prepared by Prime Minister Yasuhiro Nakasone's private advisory group.

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THE ANGLO-IRISH AGREEMENT

Facing more scepticism than ever

By Hugh Carney in Dublin

THIS WAS to have been Northern Ireland's long hot summer...

shared earlier in the year, causing serious concern within RUC ranks...

Supporters of the Agreement, rejected by Unionists for giving Dublin a say in Northern affairs...

In the workplace, sectarian fear again stalks Northern Ireland following threats to Catholics working in Loyalist areas...

Overall, though, the Government could be said to have coped with the violence that arose and that there was little or no sign of dissent within the ranks...

To date they have staged midnight "Operation of Hills" throughout the County Down town where the Anglo-Irish Agreement was signed...



Mr Peter Robinson (left): pushing Paisley aside?

impossible position, unable either to endorse or condemn the antics of Mr Robinson...

The problem for the OUP, or any Unionist with any clout who would like to get back into a dialogue with the Government...

Unionists' inclination to deal with Dublin, narrow as it is, was even further eroded in June when a proposal to introduce divorce in the Republic was defeated in a referendum...

What they are left with is a series of measures being discussed within the inter-governmental conference which, in the words of Mr Nicholas Scott...

insignia in the North, greater recognition of the Irish language, changes in the police complaints procedure...

This is unlikely to prove plain sailing. The repeal of the Flags and Emblems Act is largely symbolic...

There is also resistance on the British side to Dublin's strong call for the North's non-jury Diplock courts to be preserved over by three judges instead of one as at present...

Unionist opposition may not have halted the Agreement as it intended and the two Unionist parties are probably further apart than they have been...

To many Unionists outside the two parties or other Loyalist groups, there is a feeling that all the Agreement has done is stir up trouble...

The reaction of the two governments to this is that the Agreement was only the start of a long process of showing Unionists that any political settlement in Northern Ireland must be on the basis of equality for Nationalists...

So, as the new season begins, the agreement is still more or less on course, but probably facing more scepticism than ever within Northern Ireland itself...

Clontarf escapades, the RUC was tipped off and managed to prevent other demonstrations taking place. Certainly, these Loyalists have not proved much yet and it was notable that the thousands they hoped would attend Mr Robinson's court hearing in Dundalk earlier this month turned out to be fewer than 150.

Unionist Party, the DUP's anti-agreement partner, is disappointed that the moderate strain of Unionism may emerge. Within the OUP there is almost abject despair that Robinson-style politics is gaining momentum...

Exchange rate stability

From Mr J. Williamson Sir, John Muellbauer's arguments (August 13) regarding the need for a more competitive sterling exchange rate are compelling...

Nevertheless, the particular phrase that provoked Samuel Brittan (August 7) was unfortunate. No one should want to see the exchange rate "set on a firmly declining path"...

What is needed is not a declining trend in the exchange rate, but a once-for-all downward adjustment to a realistic level. From then on policy should aim to keep the rate roughly constant in real terms...

If inflation can be controlled by the sort of measures endorsed by both Brittan and Muellbauer, a constant real exchange rate will be compatible with a constant nominal exchange rate...

John Williamson, (Senior Fellow), Institute for International Economics, 11 Dupont Circle NW, Washington 20036, USA.

The BMA and tobacco

From Dr G. Myddleton Sir, The statement by the Government's Chief Medical Officer that smoking causes about 100,000 deaths in Britain per year, quoted by Dr John Dawson on behalf of the British Medical Association (August 14), has no scientific validity...

I presume the figure has been calculated by adding the 40,000 deaths from lung cancer, odd deaths from the result of all smoking, to some 60,000 out of the 100,000 or so deaths from coronary heart disease, also estimated to be the result of cigarette smoke...

Letters to the Editor

cigarettes and not in pipe or cigar smoke. Statistically the death rates of pipe and cigar smokers are virtually the same as for non-smokers...

Further scientific research into all possible causes of lung cancer and heart disease is urgently needed and the British Medical Association should be demanding such a programme rather than indulging in mere propaganda.

Shortages north of Watford From Sir Peter Masefield Sir, I am sorry that Mr B. R. Dewing (August 18) and the chairman of Manchester Airport (August 19) take such short-term and parochial views of the looming need for additional airports capacity in the UK...

Mr Keith Barnes quotes, with understandable pride, the 21 per cent growth of air traffic during the past 12 months through Manchester's excellent airport. He looks for future diversions of traffic thither from London's airports...

Transport history shows that well before the end of this century, Manchester airport — and Birmingham and others, too — will be stretched to meet the expanding traffic demands from their own catchment areas, let alone any overspill from London.

Price, choice and design From Mr S. Gregory Sir, Nick Garnett's note on the risks of cost-cutting (August 8), followed by Merry Unger's letter (August 16) on price and choice, have been underlined by the European Management Forum report summarised by William Dulforce (August 18). This suggests that British industry virtually specialises in low-value products.

There are alternative competitive strategies. I think it is useful to note that, although the standard cost-cutting approach — "value analysis" — has been taught and practised in the UK for more than 20 years, no procedure has been taught or obviously practised which deals with building up value in design to fit a market competitively.

Such an approach — we could call it "value creation" — requires at least a methodical search of market returns likely to be made by incremental or step changes in the product. For this to work technically specialised form of value estimating needs to be developed. Sydney A. Gregory, 22 Crescent Road, Stafford.

Fruitless search From the Chairman, Pirbright Group Sir, — Because we will need to use one, we recently wrote to 12 financial public relations agencies asking a number of questions, and requested that they reply as quickly as possible.

After two weeks we had received replies from only five. We telephoned the remaining seven — three of them said they had not received our letter, and four made excuses for not responding, blaming holidays and sickness.

We went to see three of the agencies who had replied and found that none of them had the slightest idea of how to pre-

sent themselves to a prospective client. Two of them immediately told us that we needed a new and more impressive logo, but when we looked at their logos we found them drab and unimpressive.

We settled on one of the three, and the managing director and another director visited us for three weeks we heard nothing. We then telephoned and were told that they were intending to telephone us that very day! An appointment was made for the presentation, but two days before the event a postponement was asked for.

Another date was made, but we received another phone call, once again postponing! P. Youdale, Tile House, Ridgeway Rd, Stanningdale, Berks.

A stunning building From Sandra Champness Sir, — One would be hard pressed to find a more whingeing article than that published on August 18 in your architecture column.

Quite obviously, the new Lloyd's building has faults which must be remedied but it was becoming obvious that the old Lloyd's building in all its white-marbled elegance was beginning to fall far short of requirements.

There will always be those who deplore change, but with its recent sad history Lloyd's can well do without this minor carping to add to the problems. It is a pity the "Lloyd's member" was not prepared to be named particularly since, as he so self-righteously points out, he was one who "did not fall for it" when plans for the stunning new building were originally drawn up. Sandra Champness, Stonerose, Plummers Plain, Horsham, Sussex.

Choices in cheques From Mr K. Tunstall Sir, — Harold Baldwin's article (August 16) mentioned that most companies now cross their cheques "not negotiable" for protection against claims should a thief negotiate their cheques. To similarly protect their personal customers I would suggest that banks supply cheques with pre-printed "not negotiable" crossings, or at least offer the facility. Keith Tunstall, 39 Grove Street, Leamington Spa, Warwick.

Lombard

All tanked up but nowhere to go

By Max Wilkinson

SPARE A thought for the poor petrol companies as you race past a pump offering four-star at 165p a gallon. They are faced with an appalling propaganda problem.

For the fourth time this year they are starting to prepare the public for a concerted rise in pump prices, hoping to repeat the exercise of the second week of August when, by all pushing together, they managed to get four-star up 7p to 166 a gallon.

A faintly ludicrous pattern has now been established. It starts with one petrol company briefing the press that margins have shrunk to an intolerable thinness. A few days later another oil company announces that it is compelled to put up prices and after a decent interval of about three days all the other companies have been "compelled" to follow suit.

By this means the companies avoid falling foul of competition laws which would force them to register any concerted agreement to fix prices. Not for them the furtive telephone calls or a smoke-filled room at the back of the Athenaeum; their exchange is such that conspiracy could not possibly be discovered. It is on the front pages of the national newspapers. Petrol prices exert a peculiar fascination over the British public, perhaps partly because of the annual Budget ritual.

However, so far this year the petrol companies themselves have torpedoed each concerted price rise much faster than the Office of Fair Trading could have hoped to do. Soon after each price rise, competition between the 60 to 70 wholesalers supplying the 20,000 petrol sites has eroded the price again. As a result the present price of 165p is 53p below the level in February and still well below the 175p which one large company says it needs to make a 12 per cent return on its assets.

Where do all these wholesalers get their cheap petrol from? Some have been able to make a quick profit by picking up cheap cargoes on the Rotterdam spot market and selling at a discount in the UK. However, most of their supplies come from the 12 large companies (including all the best-known brand names) which have re-

fineries in the UK. These refineries sell petrol to competitors which then undercut them. They do it because there is still about 20 per cent overcapacity in the European refining industry and a small extra throughput can make a significant difference to the overall profitability of a refinery.

This is why the three major operators, Esso, Shell and BP, which supply more than half of the UK's petrol, have effectively lost control over the market. It was not always so. During most of 1985 when a weakening dollar pushed the sterling price of crude oil down steeply, the managed to maintain impressive control. Although prices eased slightly from their high point of over 200p in March 1985, the final quarter to levels which they had not enjoyed for many years.

This year, however, the fall in crude prices has been too much in the news for its effect on pump prices to be ignored. In case anyone should forget that refiners had accelerated out of the years of loss-making sterling price of crude oil down steeply, the managed to maintain impressive control. Although prices eased slightly from their high point of over 200p in March 1985, the final quarter to levels which they had not enjoyed for many years.

Yet the oil companies have a relatively good case. Because nearly 70 per cent of the price at the pump represents excise duty and value added tax, a fall in crude oil prices has much less effect on the price than most people seem to expect. The cost of raw materials is now only about 35p per gallon.

Yet whatever the oil companies say about a "fair return" the fact remains that there is still considerable overcapacity in the refining industry. The harsh laws of economics say that free competition will reduce margins until the least efficient producer falls to cover his operating costs and goes out of business. This is what has been happening in recent years. Since 1980 a quarter of Europe's refining capacity has been closed. This painful adjustment is not yet quite complete and since refiners' costs are now pretty similar, that means a lean time for all. The only alternative is something the companies cannot talk about and cannot make work — a price cartel.

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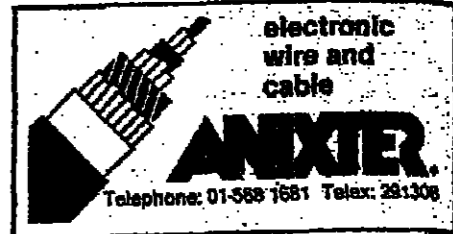
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RESERVE BANK SAYS ECONOMY 'SUBDUED BY LACK OF CONFIDENCE'

SA capital outflow hit \$1bn in first half

BY ANTHONY ROBINSON IN JOHANNESBURG

THE SOUTH AFRICAN economy, hit by social unrest, remained subdued by a lack of confidence and a pervasive sense of uncertainty about the future...

year will be in the 1.5 to 2 per cent range, rather than the 3 per cent growth forecast at the time of the March budget. Perceived threats of intensified economic sanctions and news of continued social unrest were the main factors behind the outflow of R1.56bn of short-term capital in the first half...

Sellafield a hit with tourists

BY IAN HAMILTON FAZEY IN LIVERPOOL

THE CAMPAIGN by British Nuclear Fuels (BNFL) to attract summer visitors to its reprocessing plant at Sellafield, in north-west England, has been so successful that new permanent jobs have been created...

The Sellafield reprocessing works has restarted after a four-day shutdown when levels of radiation which could have breached new government safety limits were found in waste due to be discharged into the Irish Sea.

tours of the site offered to all visitors to the exhibition. Total jobs associated with the centre and tours have risen from 18 to 30. What has surprised BNFL is that so many people have been willing to travel so far to see what looks nothing much more than a gigantic building site...

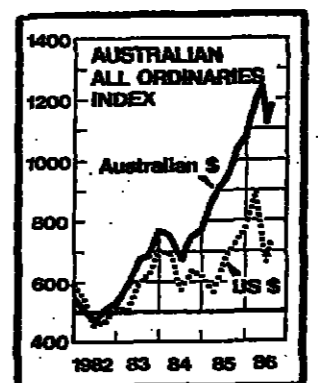
French N-plant mishap likely to delay opening

BY DAVID HOUSEGO IN PARIS

THE opening of the Cattenom nuclear power station in eastern France is likely to be delayed after an accident at the weekend which led to the flooding of underground galleries during the final verification procedures on a reactor.

Because of its proximity to the West German border and because of Chernobyl, the new Cattenom station has been the subject of continuing protests in recent weeks. An official at the plant noted the unusual rise in the water level on Saturday night when the temperature was being raised in a primary circuit on one of the 1300 MW reactors...

THE LEX COLUMN When Australians start to roam



The coincidence last week of a deflationary Australian budget and Mr Holmes a Court's polite but aggressive letter to USX is not entirely accidental; and the link will not be a great comfort to managements who have survived and prospered in such namby-pamby takeover markets as Wall Street and London...

Whether Mr Holmes a Court has bought shares in USX, (and the SEC filing will show. Whereas Wall Street has been looking at a strike-bound steel and energy company, whose share price is back at its 1982 level while the market has doubled, an Australian would be reminded of what BHP looked like three years ago. Given that USX's steel assets are a relatively small proportion of the whole, and there are substantial off-balance-sheet plums such as an overvalued pension scheme, Mr Holmes a Court could be on the way to picking up some high-quality energy properties on the cheap...

Siemens looks at BASF link

By David Brown in Frankfurt

SIEMENS, the West German electrical group, may take a significant holding in a new company combining the computer hardware and peripheral business of BASF, the giant chemicals group, and some of its own software operations, it emerged yesterday.

UK plans to try gilts auctions

BY GEORGE GRAHAM IN LONDON

THE BANK of England plans a trial series of auctions of UK government securities, similar in style to the US Treasury bond auction, after the transformation of the structure of London's gilt market in October. Britain's central bank is expected to run an experimental series of perhaps three or four auctions, probably beginning with shorter dated conventional gilts. So that investors could be certain what they were bidding for, the Bank of England would give an assurance that no further stock of the same type would be issued for a specified period.

People Express grounds Frontier

BY DAVID HOUSEGO IN PARIS

THE CRISIS enveloping People Express, the aggressive low-cost American carrier, deepened yesterday after it was forced to ground its Frontier Airlines subsidiary. It warned that Frontier could be forced into bankruptcy proceedings if its pilots did not agree to a new wages pact, write Terry Dodsworth and William Hall in New York. The move underlines the deteriorating financial condition of People Express, which had been counting on the sale of the Denver-based carrier to United Airlines for \$148m to solve its short-term cash problems. People Express said: "We deeply regret that this step had to be taken but we were left with no choice. The sale of Frontier to United is contingent upon agreements between United and its unions. To date, United's pilots' union has failed to reach agreement with United. Frontier is out of funds, and in the absence of assurance that the sale to United will take place, People Express is unwilling to commit any more of its funds to Frontier."

Unions reject Montedison bid

Continued from Page 1

The future ownership of Fermenta has become uncertain again as speculation grows that Mr El-Sayed is seeking to put together an alternative "Swedish solution" to the Montedison takeover. He is coming under pressure to find a buyer for all or part of his stake in the company before the end of the year when repayment is due of part of his SKR-14bn personal debt accumulated earlier this year when the planned sale of a 25 per cent stake in Fermenta to Volvo, the Swedish automobile and industrial concern, collapsed. Fermenta still faces the threat of an eventual expulsion from the Stockholm stock exchange.

Cadbury stake in Dr Pepper

Continued from Page 1

Canada Dry, with sales of \$242m and \$19.7m profits after tax but before extraordinary items in 1985, has almost 3 per cent of the North American soft drinks market while Dr Pepper, which made net profits of \$62m last year, has 7 per cent of the \$26bn US soft drinks market. Dr Pepper has few sales overseas. The legendary 72-year-old Mr Woodrow Wilson "Foods" Clementis is to stay with Dr Pepper's new owners as "chairman emeritus" said Mr Hicks. Mr Wilson has been with Dr Pepper for 50 years and is widely credited with its marketing success.

Conrail to be sold by public offer

By William Hall in New York

THE US Government has acknowledged defeat in its bid to sell Conrail, the state-owned railway, to Norfolk Southern, a rival railway, and cleared the way for one of the biggest stock market offerings in Wall Street's history. Norfolk Southern, which won US Government approval to buy Conrail in February 1985, withdrew its \$1.9bn offer on Friday. Mrs Elizabeth Dole, the Transportation Secretary, who had been backing Norfolk Southern's offer, said that she would work with Congress to return Conrail to the private sector through a public offering. This could happen before the end of the year, Wall Street analysts believe. The announcement is a major defeat for Mrs Dole, who has faced fierce criticism in Congress over her plans for Conrail. The company was formed in 1976 from the remains of Penn Central and half-a-dozen other bankrupt railways in the north-east. The Government has been trying to get out of the railroad business since 1981. Mrs Dole decided to sell Conrail to Norfolk Southern after reviewing other options. It was argued that Conrail was not strong enough to survive on its own. The Senate approved the Government's plan, but this ran into serious opposition in the House of Representatives, where Mr John Dingell, chairman of the Energy and Commerce Committee, opposed the Norfolk Southern offer. As every month went by, Conrail's fortunes improved. Last year it earned \$442m on revenues of \$3.2bn. Mr Dingell does not believe that Conrail's long-term health is questionable, and has said that the best way to return Conrail to the private sector is through a public offering. Conrail's management has never been happy about the prospect of being owned by Norfolk Southern and hired Morgan Stanley, the Wall Street investment bank, which offered to match Norfolk Southern's bid by making Conrail public. Soon after Allen and Co and First Boston, two New York investment banks, made a rival offer. Mr Dingell, a Michigan Democrat, praised the statesmanship of Mrs Dole and Norfolk Southern and pledged to support a renewed effort to return Conrail to the private sector. This return has been a high priority of the present Administration. The railway has had the benefit of \$7bn in subsidies and labour protection payments, but in recent years has been streamlined considerably.

British brewers

BY DAVID HOUSEGO IN PARIS

The spectre of an inquiry by Britain's Monopolies and Mergers Commission into the supply of beer in licensed premises has done notable injury to a sector of the market which had been high fashion. Since the rumours of the inquiry became authoritative rather than speculative at the beginning of July, the breweries sector has underperformed the London All-Share index by 5 per cent. This understates the damage to those shares most closely identified with the tied-house trade, since almost half the capital-

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World Weather

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By William Hall in New York

THE US Government has acknowledged defeat in its bid to sell Conrail, the state-owned railway, to Norfolk Southern, a rival railway, and cleared the way for one of the biggest stock market offerings in Wall Street's history. Norfolk Southern, which won US Government approval to buy Conrail in February 1985, withdrew its \$1.9bn offer on Friday. Mrs Elizabeth Dole, the Transportation Secretary, who had been backing Norfolk Southern's offer, said that she would work with Congress to return Conrail to the private sector through a public offering. This could happen before the end of the year, Wall Street analysts believe. The announcement is a major defeat for Mrs Dole, who has faced fierce criticism in Congress over her plans for Conrail. The company was formed in 1976 from the remains of Penn Central and half-a-dozen other bankrupt railways in the north-east. The Government has been trying to get out of the railroad business since 1981. Mrs Dole decided to sell Conrail to Norfolk Southern after reviewing other options. It was argued that Conrail was not strong enough to survive on its own. The Senate approved the Government's plan, but this ran into serious opposition in the House of Representatives, where Mr John Dingell, chairman of the Energy and Commerce Committee, opposed the Norfolk Southern offer. As every month went by, Conrail's fortunes improved. Last year it earned \$442m on revenues of \$3.2bn. Mr Dingell does not believe that Conrail's long-term health is questionable, and has said that the best way to return Conrail to the private sector is through a public offering. Conrail's management has never been happy about the prospect of being owned by Norfolk Southern and hired Morgan Stanley, the Wall Street investment bank, which offered to match Norfolk Southern's bid by making Conrail public. Soon after Allen and Co and First Boston, two New York investment banks, made a rival offer. Mr Dingell, a Michigan Democrat, praised the statesmanship of Mrs Dole and Norfolk Southern and pledged to support a renewed effort to return Conrail to the private sector. This return has been a high priority of the present Administration. The railway has had the benefit of \$7bn in subsidies and labour protection payments, but in recent years has been streamlined considerably.

SANWA INTERNATIONAL LIMITED advertisement with logo and contact information: Telephone: 041-621 1551, 01-621 0888, Telex: 887132 SANINT G.

DOUGLAS CAPABILITY IN CONSTRUCTION

SECTION II - COMPANIES AND MARKETS FINANCIAL TIMES

Tuesday August 26 1986

AE GROUP EXTENDING THE FRONTIERS OF ENGINE COMPONENT TECHNOLOGY

Firestone more than doubles income

By William Hall in New York FIRESTONE Tire & Rubber, the second-biggest US tyre manufacturer...

Currency sector draws Eurobond investor interest

THE EUROBOND market saw a flurry of new issuing activity last week and syndicate managers should be kept busy over the coming weeks...

of new offerings soon. In the Euroyen market, for instance, a large deal from Norway is rumoured. Meanwhile, in the sterling market...

mains firmly on shore. Its price level was believed to have been sustained almost entirely by UK institutions, since continental investors continue to resist the prospect of a long-term sterling bond.

ings. Last Friday, for instance, a DM 150m 12-year bond for Kauthof, the department store group, hit a bid price of 137.17 points up on the week.

That makes them seasoned operators. "I would like to have seasoned traders who know what a bear market is in the next couple of years," said Ms Annabell Svedberg, Gota (UK) managing director.

McLeod Young in search for investors

By Robert Gibbins in Montreal McLEOD Young Weir, one of Canada's largest investment banking and brokerage firms, is negotiating with several institutions wanting to buy a substantial interest in the company.

Innovative credit facility launched by British building society

BRITISH building societies have been stepping up their borrowing activity in wholesale financial markets over the last couple of years, but they have not been particularly asked for their innovation.

Lloyds also announced last week. This is a conventional transferable revolving credit carrying a margin of 5 basis points over the London interbank offered rate for sterling deposits and a commitment fee of 6 basis points payable only if less than two-thirds of the deal is drawn.

It remains to be seen whether National and Provincial's facility will arouse the same degree of debate, but one major change that has occurred between the two deals is that the market has become accustomed to fully uncommitted issues of commercial paper which carry no commitment fee.

Banks will receive a fee at the end of the year varying between one and three basis points depending on the averaged weighted level of their bids for the paper. The highest fee will be paid if the average bid margin is less than 6 basis points, the lowest if it is between 9 and 12 and there will be no fee at all if it is higher than 12.

for a Spanish bank. Bankers Trust will also be a dealer. That leaves Asia as the main focus of activity in Eurocredits. As already reported, terms on Malaysia's \$500m deal were unveiled last week while Pakistan has agreed a 1 per cent margin on its five-year, \$100m credit led by Arab Banking, Chase Manhattan, Chemical and Gulf International Bank.

Bidding is now hotting up on the \$300m credit for India's Oil and Natural Gas Commission which is expected to carry a strong Japanese tax-spared element following a growing trend in Asian deals.

EUROMARKET TURNOVER Turnover (\$m) Table with columns for Primary Market, Straight, Conv, FRN, Other, Secondary Market, and Total.

The Nippon Credit Bank (Curaçao) Finance, N.V. U.S.\$100,000,000 8 per cent. Guaranteed Notes 1993 unconditionally and irrevocably guaranteed, as to payment of principal and interest, by The Nippon Credit Bank, Ltd.

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT Japanese Yen 50,000,000,000 5 3/4% Yen Bonds due August 7, 1996 (Tenth Issue) ISSUE PRICE 100 1/2%

INTERNATIONAL CAPITAL MARKETS

US MONEY AND CREDIT

Wall St. caught napping in week of surprises

A COUPLE of surprises were sprung on the US credit markets last week, both of them providing some welcome elements of certainty after a period of drift and confusion. First came the unexpected downward revision of the second quarter gross national product (GNP) figures to a minimal 0.6 per cent, an outcome which contrasted sharply with the expectation of a slight change in the initial growth estimate of 1.1 per cent. Second, and more dramatic, was the immediate response of the Federal Reserve with a cut of half a percentage point in the discount rate to 5.5 per cent.

Wall Street was caught napping by the discount rate move because it had been arguing that the Fed would wait until well into September to confirm the way the economy was going. The hallmark of the US centrist in Washington, the chairmanship of Mr. Paul Volcker has been its unwillingness to act in a precipitate manner to bring down rates, mainly because of Mr. Volcker's preoccupation with the dangers of rekindling inflation.

Many economists had contended that after three previous discount rate reductions already this year, the most

Table with 4 columns: Instrument, Last Friday, 1 week ago, 4 wks ago, and 12-month High/Low. Includes Fed Funds, Treasury bills, and US Bond Prices and Yields.

Just as important in the Fed's decision, however, are the politics of the situation. Mr. Volcker has clearly been under considerable pressure from the Administration to keep the momentum towards lower interest rates moving forward. Indeed, the announcement was immediately welcomed by the White House—and the Republican congressional leadership has also brought its fire power to bear on the Fed.

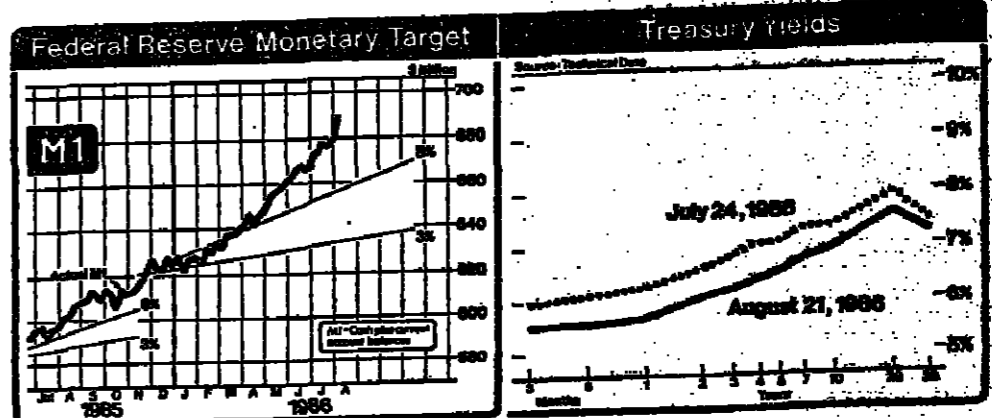
tees and a bias of opinion towards easier monetary conditions. In the event, the governors voted unanimously for the cut—and with a decisiveness which, says Mr. Allen Sinai, chief economist at Shearson Lehman, amounts to a new strategy. The US central bank, he argues in his weekly bulletin, is now showing its willingness to go it alone in trying to revive the economy without the assurance of co-ordinated international action. It is accepting the risk of using reductions in the dollar's exchange rate to improve America's competitive position and put pressure on the US's trading partners to expand their economies.

Mr. Sinai contends that the GNP figures provided a catalyst for this new approach because they showed that "the area most responsible for the ongoing weakness in the US economy and the key to stronger growth, real net exports, showed a greater deterioration than previously had been indicated. The US economy cannot be restored to healthy, balanced growth without an improvement in trade."

see both opportunities and dangers in the policy of aggressive interest rate cuts.

Early in the week, long-term rates had edged down, propelled by renewed indications of a weakening economy—indeed, some market participants argued that the yield on the 30-year Treasury long bond might be heading for the 13.10 range last seen in mid-July. On Monday and Tuesday, corporate treasurers jumped at this chance to refinance at lower long-term rates, bringing about \$2.5bn-worth of new issues to the market in just two days.

By the end of the week, everything looked different again. Yields at the long end of the interest rate spectrum headed back up as the market chewed over the inflationary risks of additional large declines in the



dollar, along with the difficulties of financing the budget and trade deficits within a lower rate structure that was less attractive to foreigners.

At the same time, short-term rates eased back, propelled by a federal funds rate which fell by more than 30 basis points up to the end of the week to around 5.50 per cent. By Friday

three-month Treasury bills stood at 5.35 per cent against 5.50 per cent at the beginning, while on the Stock Exchange, investors were showing sufficient renewed optimism over growth to push the Dow Jones industrial average back towards the 1980 level. The question left hanging over the market this week is the longer term reaction of the dol-

lar. The US currency drifted lower as expected at the end of last week but trading has been this throughout the dog days of August, and dealers believe that in a more sensitive market the dollar could easily slip below DAX (against the present DAX/USD) and YEN 150 (against 153.40).

Terry Dodsworth

UK GILTS

Hint of an auction system for securities

THE BONDS sketched by the Bank of England in its paper on the future structure of the gilt market always carried the hint of a partial move towards the auction system for selling gilt-edged securities.

"One possibility which the Bank will wish to examine is whether some part at least of the funding programme might be put on a more regular footing, with greater reliance on the primary market. The Bank will in due course wish to discuss this possibility with the market makers, including in that context management to ensure their appropriate support of the primary offerings," the Bank said last April.

While detailed discussions appear likely to be left until 27 primary dealers have recovered from the emotional stress of "Big Bang" and have settled fully into the new market structure, the message is now reaching the market that the authorities are planning an

experimental series of perhaps three or four auctions to test the water.

The shorter end of the conventional market is candidate for the first auction, followed possibly by alternative long and short auctions. Shorter maturities are thought to suffer less from the danger that the imminence of the auction itself will depress prices—as has happened on numerous occasions with the US Treasury bond auctions.

An essential element in the success of the trial auctions will be a commitment from the authorities not to issue more stock of the same type within a specified period. It is clear that an auction system would not have worked in the current gilt market, and it might appear by analogy that the tap system will not be practicable in the new market structure. Mr. Paul Temperton, economist at Merrill Lynch, calculates that the current job-

bing system has around £100m of capital whereas the 27 new market makers will have around £700m between them, and so will have much greater capacity to bid for and hold stock.

"One can envisage circumstances in which, say, following a general rise in the market all 27 primary dealers wish to be supplied with a tap stock by the Bank of England," Mr. Temperton says. "Given limited supply, it would be difficult for all of the primary dealers to be satisfied."

In a case like this, it is expected that the Bank would, in effect, conduct an informal tender, combining an auction with some element of rationing. The authorities are keen to make stock available to anyone who has independently decided to take a position, but equally they are willing to call a temporary halt if all the dealers are responding to the game very tight, such as a monetary statistic. The auction system offers the

advantage of regularity, both to the borrower and to the investor. It might, perhaps, help to avoid the periodic panics that occur when the market decides that the Government is getting behind in its funding programme. It could as an added bonus serve to iron out some of the wrinkles that the public sector borrowing requirement puts into the monetary aggregates.

Meanwhile, the market will have to cope with £500m of new stock in three tranches spread from 1990 to 2002. The stock is £200m of 11 per cent Exchequer loan, which offers bearer form and tax-free status for overseas investors, £150m of 10 per cent conversion 1996 and the same amount of 9 1/2 per cent Treasury 2002. The National Debt Commissioners are also taking on £100m of 11 per cent Exchequer 1989 and £100m of 10 1/2 per cent Exchequer 1997.

George Graham

FT/AIBD INTERNATIONAL BOND SERVICE

Large table listing international bonds with columns for Issued, Price, Yield, and various bond details. Includes sections for US Dollar, UK Gilts, and various international government and corporate bonds.

Advertisement for Australian Industry Development Corporation. Features a globe, the text 'U.S. \$100,000,000', and '8 3/4% Bonds Due 1996'. Lists various international banks and financial institutions as partners.

August 26, 1986

STRAIGHT BONDS: Yield to redemption of the mid-price. Amount issued is expressed in millions of currency units except for yen bonds, where it is in billions.
FLOATING RATE NOTES: US dollars unless indicated. Margin above six-month offered rate (three-month if above mean rate) for US dollars. C.c.p. = current coupon.
CONVERTIBLE BONDS: US dollars unless indicated. Prem = percentage premium of the current effective price of buying shares via the bond over the most recent share price.

WARRANTS: Equity warrant premium = separate premium over current share price. Bond warrant at yield = exercise yield at current warrant price.
Creating prices on August 22.

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UK COMPANY NEWS

Yorkshire-TV should make a good debut

BY RICHARD TOMKINS

Yorkshire Television, the last of the major television contractors to seek a stock market quotation, today publishes the prospectus for an offer for sale which will value it at £41.2m.

Some 8.2m shares — 25 per cent of the equity — are being sold at 125p a share by the company's four major shareholders. These are Bass, W. H. Smith, PL Publishing (a subsidiary of Pearson, which also owns the Financial Times) and Yorkshire Post Newspapers.

Having Brothers, the merchant bank, is sponsoring the issue and Cazenove is the broker. Yorkshire is coming to the market on a profits forecast of £8.25m for the year to September 30 1986, compared with

£3.6m last time, putting the shares on a prospective price/earnings multiple of 8.4. On the forecast dividend of 6.25p, the yield will be 7.04 per cent. The prospectus also highlights Yorkshire's programme-making record and draws attention to praise from the Independent Broadcasting Authority for programmes such as First Tuesday, From the Cradle To The Grave, Harry's Game, and The Beiderbecke Affair.

comment Simple mathematics dictates that if there is any logic in the stock market at all, Yorkshire Television's issue must be a success. There is little to distinguish the company from the other ITV majors, yet the issue is pitched at a price which leaves it at a significant discount to the average for Thames, Central and LWT.

Standard Chartered dismisses bid talk

By John Edwards

Press reports that the Australian banking group Westpac was planning a take-over bid for Standard Chartered Bank were "entirely speculative" and had "little credibility," according to Mr Michael McWilliam, Standard's group managing director.

Mr McWilliam said yesterday that he had no evidence of any planned bid, and it seemed an implausible idea bearing in mind the respective sizes of the two groups and the present weakness of the Australian dollar.

At the moment Australian banks generally were not in a good position to do anything overseas since their main problem was coping with their weak domestic currency. So the story made little sense, he added.

Ayrshire Metal improving after £0.3m interim loss

Reflecting depressed conditions throughout most of the first half of 1986, the results of Ayrshire Metal Products showed a downturn of £725,000 to a loss of £299,000. The directors halved the interim dividend to 0.5p net and said the full year's payment would be considered on the basis of the second half performance.

In the year 1985 the group made a profit of £780,000 and paid a final 1p. With short lead times at each of the companies' operations, forecasting remained difficult, the directors said.

engineering and steel fabrication group said they carried out a critical appraisal of the cost structure and that led to a 10 per cent reduction in numbers employed and annual cost savings in excess of £400,000. The industrial buildings market, served by the Daventry company, was showing signs of increased activity after the downturn last autumn. At St Helens the factory was busy, but poor batch quantities and reduced margins were providing lower than anticipated profits.

Sales in the 24 weeks ended June 15 1986 came to £8.34m (£9m) with the UK contribution down to £7.98m (£8.68m). The directors of this light

PENDING DIVIDENDS

Dates when some of the more important company dividend statements may be expected in the next few weeks are given in the following table. The dates shown are those of last year's announcements except where the forthcoming board meetings (indicated thus) have been officially notified. Dividends to be declared will not necessarily be at the amounts in the column headed "Announcement last year."

Table with columns: Company Name, Date, Announcement last year, Dividend, and Announcement last year. Lists various companies like AMEC, Assog, and B&A with their respective dividend details.

BOARD MEETINGS

Table listing board meetings for various companies including Amey, Amey, Amey, etc., with columns for Date, Meeting, and Location.

Network Security profit doubled

Network Security Corporation, the 26.5 per cent owned associate of Automated Security (Holdings), has announced its interim profits more than doubled at \$4.7m (£3.1m) against \$2.2m on turnover of \$30.3m.

Holographics expansion plan

At the annual meeting of Applied Holographics the chairman confirmed that production of foils was set to start next February. The chairman said orders for many millions of reflection holograms were in an advanced state of negotiation with major companies in the UK, Switzerland and the US.

Sirdar moves into curtain making

Sirdar, the hand-knitting yarn maker, has moved into the manufacture of ready made curtains through the acquisition of Eversure Textiles for an initial £2m cash.

Oil and Gas Technology Projects

European Community Funding Funds are available from the Commission of the European Community for projects which promote new technology in exploration, production, transport or storage of oil and gas.

COMPANY NEWS IN BRIEF

ROCKWOOD HOLDINGS'S 2.37m rights issue at 85p per share has been taken up as to 2.35m (about 99.2 per cent). GRAIG SHIPPING has proposed to the shareholders that it be allowed to purchase its own shares, up to a maximum of 100,000 ordinary and 40,000 A non-voting shares.

Advertisement for Sheppards, Pelly and Alford. Includes text: 'For 159 years we've been searching for the perfect name. Now the chase is off.' and 'We've been called some curious things in our time. (These are just edited highlights.) However, as people insist on calling us by our first name only, we thought we'd bow to their judgement and make it official.'

Arthur Wood in profit

A considerable improvement in demand enabled Arthur Wood & Son (Leopold) to return to the black in the first half and produce a profit of £53.814.

The group, maker of fancy earthenware, taps and bankers, said it was expecting an increase for the year over the previous £140,000, provided order books stayed at their present satisfactory level.

EDF Electricite de France

US\$300,000,000 Floating Rate Notes due 1997 with Warrants permitting exchange of Notes for ECU-denominated 94% Bonds due 1995. Notes and Bonds unconditionally guaranteed by THE REPUBLIC OF FRANCE.

NOTICE OF CALL AND REDEMPTION To the Holders of The Bank of Tokyo, Ltd., Portland Branch Certificates of Deposit due December 9, 1986 (the "Certificates")

GRANVILLE Granville & Co. Limited 8 Lovell Lane London EC3R 6BP Telephone 01-421 1212

BANQUE INDOSUEZ Floating Rate Notes Due 1991 Interest Rate 9 7/8% per annum Interest Period 21st August 1986 to 21st November 1986

U.S. \$150,000,000 Chemical New York Corporation Floating Rate Subordinated Notes Due 1996 Interest Accrual 27th May 1986

LADBROKE INDEX 1,271,277 (+4) Based on FT Index Tel: 01-427 4411

Kingdom of Spain U.S. \$375,000,000 Floating Rate Notes Due 2005 Holders of Notes of the above issue are hereby notified that for the final interest sub-period from 26th August, 1986 to 22nd September, 1986 the following will apply:

FINANCIAL TIMES STOCK INDICES Table with columns: Index Name, August 22, August 23, August 24, August 25, August 26, High, Low, and Close.

CURRENCIES, MONEY and CAPITAL MARKETS

FOREIGN EXCHANGES

Pressure grows on Bundesbank

BY JONAS GROSLAND

THE BALL was rather unceremoniously dropped into the court of the West German Bundesbank last week as the US Federal authorities stepped up their drive to breathe life into a sagging US economy.

£ IN NEW YORK

Table with columns: Aug 22, Close, Prev. close. Rows: Spot, 1 month, 3 months, 6 months, Forward premiums.

The first jolt came on Tuesday when it was announced that US second quarter growth was up 0.6 per cent over 1.1 per cent previously. This was sufficient to upset holiday season lethargy and paved the way for further measures to stave off further signs of stagnation and a weighty protectionist lobby.

Thursday's cut in the US discount rate to a nine year low of 5 1/2 per cent formed the second phase and successfully concentrated attention on how West Germany and Japan would respond.

an extent that it has moved from a position at the base of the Bundesbank's central bank rate to three months. Demand for the D-Mark has played its part in pushing the weaker members such as the Danish krone and current parity levels are going to become increasingly irrelevant unless the D-Mark is held in check.

The West German authorities are known to be cautious and there is no meeting of the Bundesbank's central bank council anticipated before Thursday's regular fortnightly gathering. However there is a band of opinion claiming that a cut in the discount rate may not be all that bitter a pill to swallow.

With a healthy trade surplus and zero inflation, there may be sufficient leeway for another cut in rates without contributing significantly to the economy's overheating. The economy's Friday's M3 money supply figures showed a DM 500m rise in July compared with DM 500m in July 1985 but at least down from DM 840m when it rose by DM 940m.

Table: LIFE LONG GILT FUTURES OPTIONS. Columns: Strike, Call, Put, Last, etc.

Table: LIFE US TREASURY BOND FUTURES OPTIONS. Columns: Strike, Call, Put, Last, etc.

Table: LONDON S/E/S OPTIONS. Columns: Strike, Call, Put, Last, etc.

Table: LIFE-EURODOLLAR OPTIONS. Columns: Strike, Call, Put, Last, etc.

Table: CHICAGO U.S. TREASURY BOND (CBT) 8 1/2%. Columns: Close, High, Low, Prev.

Table: CHICAGO U.S. TREASURY BOND (CBT) 8%. Columns: Close, High, Low, Prev.

Table: CHICAGO U.S. TREASURY BOND (CBT) 7 1/2%. Columns: Close, High, Low, Prev.

Table: CHICAGO U.S. TREASURY BOND (CBT) 7%. Columns: Close, High, Low, Prev.

Table: CHICAGO U.S. TREASURY BOND (CBT) 6 1/2%. Columns: Close, High, Low, Prev.

Table: CHICAGO U.S. TREASURY BOND (CBT) 6%. Columns: Close, High, Low, Prev.

Table: CHICAGO U.S. TREASURY BOND (CBT) 5 1/2%. Columns: Close, High, Low, Prev.

Table: CHICAGO U.S. TREASURY BOND (CBT) 5%. Columns: Close, High, Low, Prev.

Table: CHICAGO U.S. TREASURY BOND (CBT) 4 1/2%. Columns: Close, High, Low, Prev.

Table: CHICAGO U.S. TREASURY BOND (CBT) 4%. Columns: Close, High, Low, Prev.

Table: CHICAGO U.S. TREASURY BOND (CBT) 3 1/2%. Columns: Close, High, Low, Prev.

Table: CHICAGO U.S. TREASURY BOND (CBT) 3%. Columns: Close, High, Low, Prev.

Table: CHICAGO U.S. TREASURY BOND (CBT) 2 1/2%. Columns: Close, High, Low, Prev.

CURRENCY MOVEMENTS

Table: CURRENCY MOVEMENTS. Columns: August 22, Bank of England, Morgan Guaranty.

OTHER CURRENCIES

Table: OTHER CURRENCIES. Columns: Aug. 22, Close, % change.

CURRENCY RATES

Table: CURRENCY RATES. Columns: Aug. 22, Bank rate, Special Drawing Rights.

POUND SPOT—FORWARD AGAINST POUND

Table: POUND SPOT—FORWARD AGAINST POUND. Columns: Aug 22, Day's spread, Close, One month, % p.a., Three months, % p.a., 12-month, % p.a.

DOLLAR SPOT—FORWARD AGAINST DOLLAR

Table: DOLLAR SPOT—FORWARD AGAINST DOLLAR. Columns: Aug 22, Day's spread, Close, One month, % p.a., Three months, % p.a., 12-month, % p.a.

FORWARD RATES AGAINST STERLING

Table: FORWARD RATES AGAINST STERLING. Columns: Dollar, D-Mark, French Franc, Swiss Franc, Japanese Yen.

EURO-CURRENCY INTEREST RATES

Table: EURO-CURRENCY INTEREST RATES. Columns: August 22, Short term, 7 days, 1 month, 3 months, 6 months, 12 months.

EMS EUROPEAN CURRENCY UNIT RATES

Table: EMS EUROPEAN CURRENCY UNIT RATES. Columns: Currency, % change, Divergence limit.

MONEY MARKETS

Bank applies the brakes

SOME LESS than others would claim that they never thought UK base rates were going to be cut soon before the Bank of England's "not yet" signal last week.

NEW YORK RATES

Table: NEW YORK RATES. Columns: Name, Rate, % p.a.

BANK OF ENGLAND TREASURY BILL TENDER

Table: BANK OF ENGLAND TREASURY BILL TENDER. Columns: Bills on offer, £100m, £100m, Top Accepted, £100m, £100m.

FT LONDON INTERBANK FIXING

Table: FT LONDON INTERBANK FIXING. Columns: Three months US dollars, bid 5 1/2, Offer 5 1/2.

LONDON MONEY RATES

Table: LONDON MONEY RATES. Columns: August 22, Over night, 7 days notice, Month, Three months, Six months, One year.

WEEKLY CHANGE IN WORLD INTEREST RATES

Table: WEEKLY CHANGE IN WORLD INTEREST RATES. Columns: LONDON, NEW YORK, AMSTERDAM, TOKYO.

MONEY RATES

Table: MONEY RATES. Columns: August 22, One Month, Two Months, Three Months, Six Months, Lombard.

Company Notices

Bank of Tokyo (Curaçao) Holding N.V. (Incorporated with limited liability in the Netherlands Antilles) GUARANTEED FLOATING RATE NOTES DUE 1990

GEOPUN CONVERTIBLE BONDS NOTICE IS HEREBY GIVEN TO holders of bearer shares of Geopun Convertible Bonds...

Clubs EVE has published the others because of a policy of fair play and value for money.

WestLB Eurobonds • DM Bonds • Schuldscheine for dealing prices call

WORLD VALUE OF THE POUND The table below gives the latest available rates of exchange for the pound against various currencies on August 22, 1986.

Table: WORLD VALUE OF THE POUND. Columns: COUNTRY, CURRENCY, VALUE OF £ STERLING.



Self in it

Financial Times Tuesday August 26 1986 LONDON RECENT ISSUES

AUTHORISED UNIT TRUSTS

FT UNIT TRUST INFORMATION SERVICE

EQUITIES

Table of equity prices with columns for Name, Price, Change, and % Change.

FIXED INTEREST STOCKS

Table of fixed interest stocks with columns for Name, Price, Change, and % Change.

"RIGHTS" OFFERS

Table of rights offers with columns for Name, Price, Change, and % Change.

Table of authorized unit trusts (left column) with columns for Name, Price, Change, and % Change.

Table of authorized unit trusts (right column) with columns for Name, Price, Change, and % Change.

Table of authorized unit trusts (further right column) with columns for Name, Price, Change, and % Change.

Disclaimer text regarding the accuracy of the data and the responsibility of the publisher.

Advertisement for MOPS (Mail Order Protection Scheme) featuring a crossword puzzle and promotional text.

Additional text or notes related to the unit trust information.

Additional text or notes related to the unit trust information.

Additional text or notes related to the unit trust information.

FT CROSSWORD PUZZLE No. 6108

The crossword puzzle grid with numbered squares.

Crossword puzzle clues for Across and Down, including '1 You French kissers show up well in a bed (6)'.

Table of authorized unit trusts (middle column) with columns for Name, Price, Change, and % Change.

Table of authorized unit trusts (right column) with columns for Name, Price, Change, and % Change.

Table of authorized unit trusts (further right column) with columns for Name, Price, Change, and % Change.

AUTHORISED UNIT TRUSTS & INSURANCES

Table listing various insurance companies and their unit trusts, including Waverley Asset Management Ltd, WestAren Unit Trust Managers Ltd, and Windsor Trust Funds Ltd.

Table listing insurance companies such as City of Edinburgh Life Assurance, City of Westminster Assurance, and Equitable Life Ass Soc - Condit.

Table listing insurance companies including Hill Sumner Life Assur. Ltd, M & G Group, and National Provident Institution.

Table listing insurance companies such as Prudential Life Assurance Co Ltd, Scottish Life Assurance Co Ltd, and Scottish Widows' Group.

INSURANCES

Table listing insurance companies like AA Friendly Society, Abbey Life Assurance Co Ltd, and Actua Life Insurance Co Ltd.

Table listing insurance companies including Equitable Life Ass Soc - Condit, Hill Sumner Life Assur. Ltd, and M & G Group.

Table listing insurance companies such as National Provident Institution, Norwich Union Asset Management Ltd, and Prudential Assurance Co.

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Table listing insurance companies including AA Friendly Society, Abbey Life Assurance Co Ltd, and Actua Life Insurance Co Ltd.

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INSURANCE, OVERSEAS & MONEY FUNDS

Table listing various insurance and financial products with columns for company names, product types, and numerical values.

Table listing various insurance and financial products, including a section for 'MANAGEMENT SERVICES'.

Table listing various insurance and financial products, including a section for 'OFFSHORE AND OVERSEAS'.

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Table of British Funds with columns for Name, Price, Last, and Yield. Includes sections for 'Shorts (Lives up to Five Years)', 'Five to Fifteen Years', and 'Over Fifteen Years'.

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Table of Beers, Wines & Spirits funds.

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Table of Building, Timber, Roads funds.

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Table of Beers, Wines & Spirits funds.

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DRAPERY & STORES

Table of Drapery and Stores shares.

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Table of Beers, Wines & Spirits shares.

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INDUSTRIALS (MISC.)

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ENGINEERING (MISC.)

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INDUSTRIALS (MISC.)

Table of Industrials (Miscellaneous) shares.





THIS NOTICE IS IMPORTANT AND REQUIRES THE IMMEDIATE ATTENTION OF HOLDERS OF BONDS. IF HOLDERS ARE ABSENT FROM THE MARKET ON THE DATE OF THIS NOTICE THEY SHOULD TAKE THE NECESSARY STEPS TO CONSULT THEIR STOCKBROKER, LAWYER, ACCOUNTANT OR ANY OTHER PROFESSIONAL ADVISER WITHOUT DELAY.

NZI OVERSEAS FINANCE N.V.

Notice to the holders of the outstanding US\$50,000,000 10 1/2 per cent. Guaranteed Convertible Bonds Due 1994 denominated in US Dollars ("the Bonds") convertible into ordinary shares of NZI Corporation Limited ("Ordinary Shares").

Conversion Right Expiry Date: 20th October, 1986 Redemption Date: 27th October, 1986

NOTICE OF REDEMPTION

NOTICE IS HEREBY GIVEN to the holders of the outstanding Bonds that, in accordance with the Conditions endorsed on the Bonds ("the Conditions") and pursuant to the provisions of the Trust Deed dated 1st November, 1984 ("the Trust Deed")...

RIGHTS OF CONVERSION

Holders of Bonds are reminded that they may exercise their right to convert the principal amount of his Bond(s) into Ordinary Shares not later than 20th October, 1986.

Bonds may be converted into Ordinary Shares at the Conversion Price of NZ\$1.32 per Ordinary Share which using the fixed exchange rate specified in the Conditions of NZ\$1=US\$0.4671 results in a conversion rate of 1655.2778 Ordinary Shares for each US\$1,000 principal amount of Bonds.

As provided in the Conditions, any holder of Bonds who wishes to exercise his right to convert must obtain a Conversion Notice from the specified office of any Conversion Agent (set out on the reverse of the Bonds and at the foot of this Notice), complete and sign the same in accordance with the instructions thereon and deliver it with his Bond(s), together with all unexpired Coupons, at the specified office of any Conversion Agent at any time up to the close of business on 20th October, 1986.

On 11th August, 1986 the Current Market Price (as defined in the Trust Deed) of the Ordinary Shares on the New Zealand Stock Exchange was NZ\$1.895 per Ordinary Share (which converted into US Dollars at the rate of exchange on 8th August, 1986 is equivalent to US\$0.966). At such price, the holder of a Bond of US\$1,000 principal amount would receive upon conversion Ordinary Shares having a value of US\$1,503.096.

SO LONG AS THE MARKET VALUE OF ORDINARY SHARES IS NZ\$1.34 OR MORE (AND ASSUMING NO ADVERSE MOVEMENTS IN THE AFORESAID RATE OF EXCHANGE), HOLDERS OF BONDS WILL UPON CONVERSION RECEIVE ORDINARY SHARES HAVING IN AGGREGATE A GREATER MARKET VALUE THAN THE CASH WHICH THEY WOULD RECEIVE ON REDEMPTION OF THEIR BONDS.

IMPORTANT

Value of the Ordinary Shares into which each US\$1,000 principal amount of Bonds is convertible based on the Current Market Price of the Ordinary Shares on the New Zealand Stock Exchange on 11th August, 1986 (converted into US Dollars on the basis referred to above) of US\$0.966 per Ordinary Share. US\$1,503.096

Redemption price (including accrued interest) for each US\$1,000 principal amount of Bonds. US\$1,055.37

If any holder of Bonds wishes to accept redemption at the redemption price (including accrued interest) he should surrender his Bond(s) together with all unexpired Coupons at the specified office of any Paying Agent (set out on the reverse of the Bonds and at the foot of this Notice) on or after 27th October, 1986.

The attention of holders of the Bonds is drawn to the Conditions and in particular to Conditions 5 and 7 which contain further details regarding redemption and conversion. Copies of the Trust Deed are available for inspection at the registered office of the Trustee at Estates House, 66 Gresham Street, London EC2V 7HX and at the offices of the Paying Agents and Conversion Agents specified below.

PRINCIPAL PAYING AGENT

Citibank, N.A., Citibank House, 338 Strand, London WC2R 1HB

PAYING AGENTS

- Citibank, N.A., Citicenter, 92073 Paris la Defense, Luxembourg. Citibank, N.A., Avenue de Tervuren 249, B-1150 Brussels. Citibank, N.A., Seestrasse 25, CH 8022 Zurich. Citibank, N.A., Hengracht 545/549, Amsterdam. Citibank, N.A., Neue Mainzer Strasse 40/42, D-6000 Frankfurt/Main 1.



Diamond Shamrock ends its search

By William Hall

DIAMOND SHAMROCK, the Dallas-based energy group which recently slashed its dividend following the collapse in oil prices, has ended its six-month search for a new chief for its exploration operations. It has appointed Mr Charles L. Blackburn, 58, to be president of Diamond Shamrock Exploration Company.

Meanwhile, Mr Jack E. Little, a senior vice-president of Shell, has been promoted to executive vice-president. He succeeds Mr Blackburn, one of three executive directors of Shell Oil and head of its worldwide exploration and production operations.

He will fill a vacuum at the top of Diamond Shamrock, which has been searching for a new exploration chief since March when it announced it was consolidating its international and domestic exploration companies and dismissing Mr C. Dalton Groves and Mr C. Dale McQuillett, the two executives running the exploration operations.

They have left Diamond Shamrock, with several other executives including Mr J. L. Jackson, the group's president, who resigned last month.

Diamond Shamrock is in the process of selling its coal and chemical businesses and concentrating on its oil and gas businesses.

New head for Gotabanken

By Sara Webb in Stockholm

MR SVEN ERIK RAGNAR, one of five managing directors at Skandinaviska Enskilda Banken, has been appointed president and chief executive of Gotabanken.

Gotabanken is the fourth largest commercial bank in Sweden. The post has been vacant since the resignation of Mr Hans Mikaelsson for personal reasons. Mr Ragnar will take up office on October 1.

Mr Ragnar has spent the past 23 years working for Skandinaviska Enskilda Banken but says "with tougher competition on the banking scene and in the credit and capital markets, it will be a challenge to go to something new. A smaller bank with more aggressive and innovative."

Former office junior in line to take top job at K Mart

BY WILLIAM HALL IN NEW YORK

MR JOSEPH E. ANTONINI, who joined K Mart, the second-biggest US retailer, as a stock boy 22 years ago, has been appointed president and chief operating officer, putting him in line to succeed Mr Bernard M. Fauber as chief executive, when Mr Fauber retires at the end of next year.

Mr Antonini has worked his way through the ranks of the company. Last January he was appointed an executive vice-president and chief operating officer of K Mart's apparel division. He joined the company at the age of 22 and moved up to assistant manager of S. S. Kresge stores in New York, Pennsylvania and Connecticut.

As president and chief operating officer he will be responsible for all operating divisions of K Mart. Reporting to him will be Mr Larry M. Parkin, executive vice-president for K Mart stores, Mr Frederick Stevens, executive vice-president for specialty retailing, and Mr Joseph Thomas, executive vice-president and chief administrative officer.

K Mart, which posted sales of \$2.6bn last year, employs more than 300,000 staff worldwide. In the first half of its current financial year its net income jumped from \$37.6m to \$133.5m.

Edmund de Rothschild in tar sands project

BY ROBERT GIBBENS IN MONTREAL

M. EDMUND DE ROTHSCHILD, a former chairman of investment bankers N. M. Rothschild of the UK, is becoming involved in a major tar sands mining and extraction project in Alberta.

Mr Rothschild has helped to promote and finance a number of large energy projects in Canada, most conspicuously the CFB (CIS/780m) Churchill Falls hydro project in Labrador, completed in the early 1970s and now regarded as one of the greatest energy bargains ever.

Churchill River at Churchill Falls, about 1,000 miles northeast of Montreal, was diverted to drive turbines with a capacity of 5,000 Mw. The project was completed in time, on budget and before the 1973 energy crisis, and the power is now sold to Quebec.

Mr de Rothschild has been appointed a director of Solv-Ex Corporation of Albuquerque, New Mexico, which with Shell

Emmerson to lead RCA Red Seal

By Paul Taylor in New York

MR MICHAEL EMMERSON, the president of London Artists, an international artists' management company based in London, has been appointed president of RCA Red Seal, which carries the RCA group's classical music label.

Mr Emmerson, who will be based at RCA/Ariola's New York headquarters, will report to Mr Elliot Goldman, president and chief executive of RCA/Ariola. Before running London Artists, Mr Emmerson worked in concert promotion presenting such artists in Britain as Andrzej Segovia, Arthur Schnabel, Sarah Vaughan and Pete Seeger.

He also has extensive experience of the professional theatre. This includes stage direction and management of the Royal Shakespeare touring company. He founded and directed the Newcastle upon Tyne festival and for eight years ran the Belfast Festival in Northern Ireland.

Mr Goldman, announcing the appointment, said: "Michael's extensive experience with and knowledge of classical music and his very special worldwide market made him a natural candidate for the important position of president of Red Seal."

Work on existing orders is, the group says, to continue as normal. There is to be, it adds, an active acquisition effort for such vessels as the "Lela", which vessel is to be commissioned soon.

Mr Ludwig's commission includes investigating the possibility of setting up a dredging division as an independent unit.

Mr Ludwig will be in charge of reorganisation plans for the dredging division. These contain a first phase a major reduction in staffing and elimination of the fleet of older vessels for which no profitable employment can be found.

Mr Ludwig is to continue as active acquisition effort for such vessels as the "Lela", which vessel is to be commissioned soon.

Mr Ludwig's commission includes investigating the possibility of setting up a dredging division as an independent unit.

California bound

THE ROYAL BANK OF Scotland has appointed Mr James M. Stott, deputy manager of its San Francisco agency and representative of the bank's New York branch and representative offices by Mr Alexander D. Wilson.

Canada's science minister to have Howe as aide

BY ROBERT GIBBENS

MR BRUCE HOWE, one of western Canada's best-known businessmen, moved to Ottawa at the end of November to become secretary to the Minister of Science and Technology, a job that is equivalent to that of deputy minister.

Mr Howe was born in Dryden, Ontario, and a chemical engineer by training, joined British Columbia Resources Investment Corporation (BRIC) in 1980 as president and chief executive from the presidency of Macmillan

Bloedel, the forest products concern. Later, he became chairman and chief executive of Mr L. Jack Smith president. Mr Smith moved to BRIC from Westcoast Transmission five years ago.

Mr Howe remains as chairman of BRIC until November, while Mr Smith also assumes the title of chief executive.

BRIC is a leading holding company started a decade ago by the British Columbia Government.

Table with columns for bond numbers and values. Includes title 'NORSK HYDRO A/S 12% EURO-NOK LOAN OF 1983/1991' and 'The following Bonds have been drawn for lot for redemption on 15th October 1986 - 1st instalment:'.

Table with columns for bond numbers and values. Includes title 'COMMERZBANK OVERSEAS FINANCE N.V. U.S. \$100,000,000 Floating Rate Notes Due 1989' and 'In accordance with the provisions of the Notes notice is hereby given that for the three months period from August 21, 1986 to November 21, 1986 the Notes will pay an interest rate of 6 3/4% per annum with a coupon amount of U.S. \$156.13.'



Journalist

WORLD STOCK MARKETS

Table of world stock markets including Austria, Germany, Norway, Australia, Japan, Canada, and others. Columns include country, date, price, and change.

Table of Canadian stock markets including Toronto and Montreal. Columns include stock name, price, and change.

Table of stock indices including New York Dow Jones, Standard and Poors, and others. Columns include index name, value, and change.

Table of over-the-counter market closing prices for various stocks. Columns include stock name, price, and change.

Table of NYSE Consolidated 1500 Actives showing trading volume and price changes for various stocks.

Table of NYSE Composite Closing Prices showing closing prices for various stock indices.

Beneficial acts to thwart unfriendly takeover. BY WILLIAM HALL IN NEW YORK. Beneficial Corporation, a Delaware-based insurance and consumer finance group...

Beneficial's directors have authorized the company's management and First Boston to evaluate thoroughly the "full range of tactical and strategic alternatives that would enable us to maximize value for shareholders..."

Table of NYSE Composite Closing Prices for various stock indices and sectors.

AMSTERDAM/DELFT/EINDHOVEN GRONINGEN/DE HAGUE/HAARLEM/HEEMSTEDEN/LEIDEN/LEIDERDORP/OEGSTGEEST/RISWIJK/ROTTERDAM/UTRECHT/WASSENAR THE NETHERLANDS

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ANTWERP/BRUSSELS/GENT/KORTRIJK LEUVEN/LIEGE/LUXEMBOURG BELGIUM & LUXEMBOURG. Your subscription copy of the FINANCIAL TIMES can be hand-delivered to your office in the centre of any of the cities listed above.

# NEW YORK STOCK EXCHANGE COMPOSITE CLOSING PRICES

12 Month High	Low	Stock	Div. Yld. %	P/E	100s High	Low	Close	Prev. Close	12 Month High	Low	Stock	Div. Yld. %	P/E	100s High	Low	Close	Prev. Close
124 1/2	100 3/4	AMR	4.1	18	31 1/4	29 1/2	30 1/2	30 1/2	124 1/2	100 3/4	AMR	4.1	18	31 1/4	29 1/2	30 1/2	30 1/2
10 1/2	10 1/4	AO	3.2	18	22 3/4	21 3/4	22 1/4	22 1/4	10 1/2	10 1/4	AO	3.2	18	22 3/4	21 3/4	22 1/4	22 1/4
30 1/2	28 1/2	AFG	3.6	17	33 3/4	32 3/4	33 1/4	33 1/4	30 1/2	28 1/2	AFG	3.6	17	33 3/4	32 3/4	33 1/4	33 1/4
11 1/2	11 1/4	ADCA	3.1	16	23 3/4	22 3/4	23 1/4	23 1/4	11 1/2	11 1/4	ADCA	3.1	16	23 3/4	22 3/4	23 1/4	23 1/4
19 1/2	18 3/4	AMC	3.4	14	26 3/4	25 3/4	26 1/4	26 1/4	19 1/2	18 3/4	AMC	3.4	14	26 3/4	25 3/4	26 1/4	26 1/4
11 1/2	11 1/4	AMR	3.8	14	25 3/4	24 3/4	25 1/4	25 1/4	11 1/2	11 1/4	AMR	3.8	14	25 3/4	24 3/4	25 1/4	25 1/4
12 1/2	12 1/4	AMR	3.2	14	24 3/4	23 3/4	24 1/4	24 1/4	12 1/2	12 1/4	AMR	3.2	14	24 3/4	23 3/4	24 1/4	24 1/4
11 1/2	11 1/4	AMR	3.5	14	24 3/4	23 3/4	24 1/4	24 1/4	11 1/2	11 1/4	AMR	3.5	14	24 3/4	23 3/4	24 1/4	24 1/4
12 1/2	12 1/4	AMR	3.3	14	24 3/4	23 3/4	24 1/4	24 1/4	12 1/2	12 1/4	AMR	3.3	14	24 3/4	23 3/4	24 1/4	24 1/4
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12 1/2	12 1/4	AMR	3.6	14	24 3/4	23 3/4	24 1/4	24 1/4	12 1/2	12 1/4	AMR	3.6	14	24 3/4	23 3/4	24 1/4	24 1/4
12 1/2	12 1/4	AMR	3.7	14	24 3/4	23 3/4	24 1/4	24 1/4	12 1/2	12 1/4	AMR	3.7	14	24 3/4	23 3/4	24 1/4	24 1/4
12 1/2	12 1/4	AMR	3.8	14	24 3/4	23 3/4	24 1/4	24 1/4	12 1/2	12 1/4	AMR	3.8	14	24 3/4	23 3/4	24 1/4	24 1/4
12 1/2	12 1/4	AMR	3.9	14	24 3/4	23 3/4	24 1/4	24 1/4	12 1/2	12 1/4	AMR	3.9	14	24 3/4	23 3/4	24 1/4	24 1/4
12 1/2	12 1/4	AMR	4.0	14	24 3/4	23 3/4	24 1/4	24 1/4	12 1/2	12 1/4	AMR	4.0	14	24 3/4	23 3/4	24 1/4	24 1/4

## Kidder, Peabody International Limited

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NYSE COMPOSITE CLOSING PRICES

AMEX COMPOSITE CLOSING PRICES

Table of NYSE Composite Closing Prices. Columns include 12 Month High/Low, Stock Name, Div. Yld., P/E, 52 Week High/Low, and Change. Includes sub-sections for 'Continued from Page 28' and 'Continued on Page 27'.

Table of AMEX Composite Closing Prices. Columns include Stock Name, Div. Yld., P/E, 52 Week High/Low, and Change. Includes sub-sections for 'Continued from Page 28' and 'Continued on Page 27'.

OVER-THE-COUNTER Nasdaq national market, closing prices

Table of Over-the-Counter (Nasdaq) Closing Prices. Columns include Stock Name, Div. Yld., P/E, 52 Week High/Low, and Change. Includes sub-sections for 'Continued on Page 27' and 'Continued on Page 28'.



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# FINANCIAL TIMES SURVEY

## Aerospace

The overall long-term outlook for the world's aerospace industries remains bright, despite severe current problems in some areas, such as airline finances, pressures on some defence budgets, and difficulties with the US space programme.

### Pace likely to accelerate

THE WORLD'S aerospace industries gather for the biennial Farnborough Air Show, starting next Sunday, in the knowledge that for the rest of this century the pace of their activities is likely to accelerate rather than slacken.

While several major billion-dollar civil and military aircraft, engine, guided weapons and space programmes are already under way, and will come to fruition in the years ahead, many other new ones are in the conceptual or early planning stages.

As these mature, they will provide massive additional workloads, while also driving the frontiers of technology further forward.

In the UK alone, several major decisions are pending. For civil aircraft these include participation in the new European Airbus A-350 high-density short-to-medium range and A-340 four-engine long-range transport programmes.

In military aviation, full-scale development of the four-nation Eurofighter will be sought around the middle of next year, while before then a decision will have to be taken on the future of the Nimrod airborne early warning aircraft programme.

In helicopters, future participation in the joint Anglo-Italian A-129 light attack helicopter and the possibility of the multinational European NH-90 helicopter for the 1990s will have to be settled. And in space, decisions on involvement in such ventures as the projected Horizontal Take-Off

and Landing (Hotol) "trans-atmospheric vehicle" will have to be taken.

UK Government financial involvement in all these ventures will be such that the scope and style of the Government's management of its investments will also need to be reconsidered. The Commons Defence Committee has already urged that a Ministerial Aerospace Board should be considered as a means of co-ordinating government involvement in aerospace

By Michael Donne, Aerospace Correspondent

and of avoiding future political imbroglios such as that surrounding last winter's Westland affair.

Such a board would have broad aerospace industry approval, for the kind of disaster experienced last winter does no section of the industry any good since it lowers confidence in the Government's ability to handle the industry's complex affairs expeditiously and efficiently.

All the ventures outlined will be critical to the full exploitation of the UK's industry's own skills and resources through to the end of this century, if it is to win its share of growing world markets for aerospace products of all kinds.

It has been estimated that total Western world markets for aerospace and related equipment - civil and military aircraft, engines, guided weapons, spacecraft and avionics - will amount collectively to some \$1,500bn by the end

of this century.

Although some arenas, such as civil aviation, are more sensitive to economic cycles than others, overall the trend in aerospace and related spending is likely to be upwards, the rates varying according to region and short-term developments - although the latter may be of less significance than they may immediately appear. The difficulties encountered by some airlines on the North Atlantic routes this summer,

for example, through the slackening of US traffic to Europe, is not likely to be a long-term problem, although it may have an immediate impact on some airline balance sheets and even slow some re-equipment programmes.

More significant longer-term problems are likely to be the continued over-capacity on North Atlantic and elsewhere, which can be corrected only by the airlines themselves exercising tighter control over their own scheduling, and the need for a more measured pace in the expansion of deregulation.

The near-disastrous financial results for many US airlines in the first half of this year illustrates the damage that can be caused by unbridled deregulation and its consequent fares wars, which may be of short-term benefit to the consumer but of dubious long-term value to the stability of the air transport industry.

This is just as much the case in Western Europe as in the US, where the finances of many airlines are still weak, which accounts in turn for much of the hostility that pressures for deregulation arouse. That deregulation is inevitable is becoming more widely accepted, although there is still a considerable way to go. There are still some considerable differences of view over the pace at which it should be implemented.

Nevertheless, in commercial aviation, all the major manufacturers agree that between now and the end of the century there will be a massive market for jet airliners amounting to more than \$250bn, and accounting for upwards of 5,500 new aircraft of all kinds.

These will be needed both to replace existing ageing fleets and to meet traffic growth. In addition, there will be a major demand for smaller aircraft to meet the growing needs of the commuter and regional aviation sectors.

General aviation, which includes the business aircraft sector as well as the provision of light aircraft for other purposes including leisure flying, has been slower to expand in recent years.

Manufacturers, especially in the US, have been seriously affected by such problems as the increasing costs of product liability insurance, stemming from rapidly-escalating court awards in liability litigation.

This has so inflated the prices

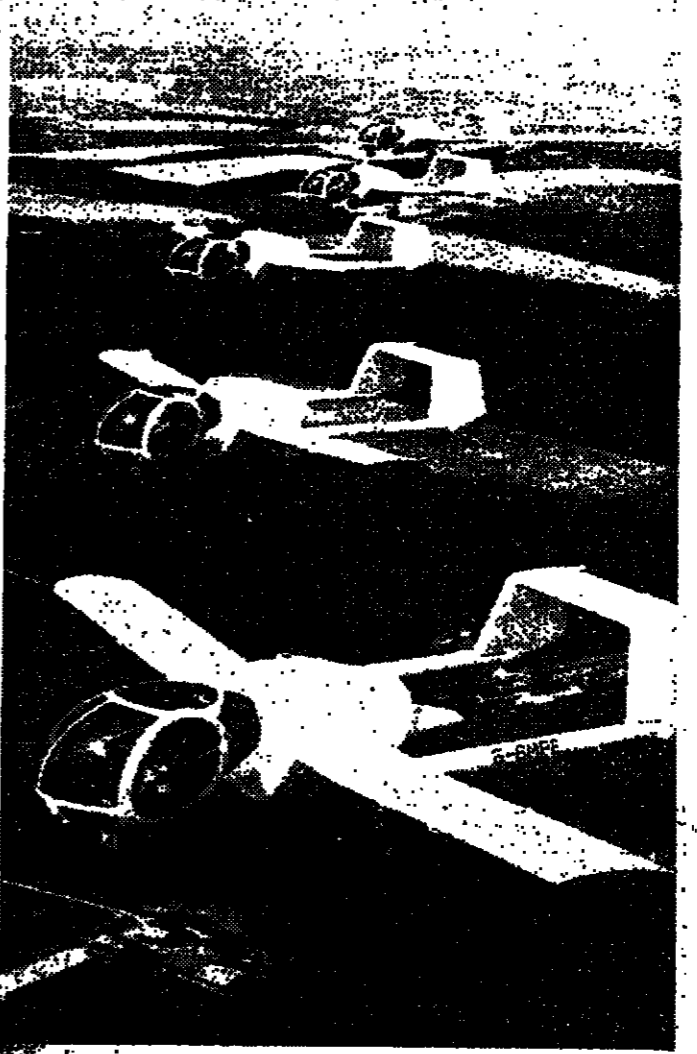
CONTINUED ON PAGE 2



Above: The UK's £150m Experimental Aircraft Programme "technology demonstrator" fighter has now made its maiden flight and will be seen at the Farnborough Air Show. Its rival, the French Dassault-Breguet Rafale (left) will also appear in the flying display.



Below: The distinctive British-built Optica light surveillance and general duties aircraft. Production of the Bug-eye, as it is nicknamed, is expanding at the Old Sarum factory.



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# WESTLAND

## Famous for its European Lynx. (And its European links.)

FRANCE - 40 ANGLO-FRENCH LYNX DELIVERED TO THE AERONAUTIQUE NAVALE

BRITAIN - 26 ANGLO-FRENCH LYNX ORDERED FOR THE BRITISH ARMY

WEST GERMANY - 19 ANGLO-FRENCH LYNX ORDERED FOR THE BUNDESMARINE

EH 101 - A NEW NAVAL HELICOPTER BEING DEVELOPED JOINTLY BY WESTLAND AND AGUSTA OF ITALY

GAZELLE - FRANCO-BRITISH COMMUNICATIONS HELICOPTER IN WORLDWIDE CIVIL AND MILITARY SERVICE

NETHERLANDS - 24 ANGLO-FRENCH LYNX DELIVERED TO THE KONINKLIJKE MARINE

Lynx is the name of one of the world's most successful helicopters. It's also the result of just one of Westland's highly successful international collaborative ventures.

Over the last nineteen years, Westland have worked with Aerospatiale of France to produce not only the Lynx, but also the Puma and the Gazelle. And that's just one of our international links.

We've been in partnership with Sikorsky, to take another example, since the Second World War. Out of that pool of expertise and experience have emerged such well-known names as Dragonfly, Wessex, Whirlwind and Sea King. And now we're working together more closely than ever to produce the new Black Hawk helicopter.

Agusta of Italy are another company with which Westland have longstanding and strong ties. Now Westland and Agusta have joined forces to design and build NATO's major naval helicopter for the 1990s, the EH101.

Westland is working with companies in five European countries on two new helicopter projects, the NH90 and the Light Attack Helicopter. We're involved in advanced airborne technology and hovercraft. And we're constantly working on new projects for the future.

We call it team technology. And it works.

## WESTLAND TEAM TECHNOLOGY

# Pace is likely to accelerate

CONTINUED FROM PAGE 1

of small light aircraft as to drive down sales and threaten the viability of some manufacturers. Legislation to regain some control over this situation is now pending, but it remains a problem that every world aerospace manufacturer of civil aircraft views with concern, especially if he is exporting to the US, as most are.

In military aviation, pressures on some defence budgets, including the UK, have either resulted in, or threaten, some near-term reductions in military aerospace spending, and the possibility of some further constraints, such as more stringent siting of plants for new projects, may emerge.

However, in the long-term, overall spending on defence in the non-Communist world seems likely to grow between now and the end of this century.

Spending on military aircraft alone is estimated to amount to more than \$500bn over the next 14 years, with especially large markets emerging for tactical combat aircraft.

New programmes already being initiated in Europe include the Eurofighter between the UK, West Germany, Italy and Spain, and the French Rafale with possible collaboration from the Netherlands and Belgium and Norway. In the US there are plans for new Advanced Tactical fighters for both the US Air Force and Navy, and an Advanced Technology Bomber (ATB) for the USAF.

Another major expanding aerospace market is avionics, now a multi-billion dollar business worldwide. About one-third of the value of all civil and military aircraft, engine, guided weapons and space is accounted for by equipment of all kinds, of which in turn avionics—airborne electronics—ranging from radars through to navigation and flight control systems and guidance systems—accounts for a substantial proportion.

In turn, the increasingly stringent performance demands of modern aerospace vehicles are placing ever more severe pressures on the avionics industry. Avionics is already the spearhead for the entire electronics industry, and the technological advances now taking place will be just as far-reaching in their impact on other industries as those other developments occurring in such

nation's technological capabilities, and more and more countries are promoting the development of aerospace industries, especially in the Third World, and especially in South East Asia.

One of the most significant developments over recent years, and one of which many of these smaller countries are now taking advantage has been the growth of international collaboration on a wide variety of aerospace ventures, despite the continuation of intense competition.

This covers the entire aerospace spectrum. In commercial aircraft, Airbus Industrie in Western Europe is the prime example. In aero-engines, the five-nation consortium, International Aero-Engines, building the Y200 engine for the European A-320 Airbus, is strong evidence of the trend.

In military aviation, the forthcoming Eurofighter and the current Tornado combat aircraft also illustrate the trend, while the European Space Agency, the Franco-German Euromissile group, and the Anglo-Italian EH-101 helicopter venture are all excellent examples of what international collaboration in aerospace can achieve.

As the costs of individual aerospace projects continue to soar into the multi-billion dollar bracket, collaboration as a means of widening markets and sharing the costs increasingly will dominate the world aerospace industry.

There have even been suggestions of collaboration for profitably this year have dropped sharply in the past three months for many carriers. There are exceptions, of course, but in general, the trend is down, though mixed.

"We estimate that, at best, the industry could show a break-even result this year or possibly a marginal profit. At worst, the losses could amount to \$1bn or more."

Mr Eser went on to point out that the possibility of profits depended on what savings on fuel costs actually occurred, and on how traffic growth recovered as the summer progressed.

"On the fuel side, while prices have come down substantially in certain highly competitive supply locations like London, New York and Paris, on the whole the scale of reduction has been far short of the drop in crude oil prices.

"For example, in the 12 months to the end of May, crude oil prices fell by about 55 per cent. Jet fuel prices, however, as reported by members to us, showed an average reduction of

# Bleak outlook as traffic growth slows

## Airlines

THE FINANCIAL outlook for the world's airlines is bleaker than at any time since the recession of the early 1980s, with traffic growing at a slower rate in many regions, especially on the North Atlantic routes, but with capacity growing at too rapid a rate, so that revenue yields are declining.

Earlier this year, Mr Gunter Eser, director-general of the International Air Transport Association, suggested that 1986 potentially could be a good year in terms of airline industry profitability, if two conditions were met: that the drop in crude oil prices was passed on by the oil companies in equivalent reductions in the price of jet fuel, and that capacity increases were in line with projected traffic growth.

More recently, in the light of the first six months' results, Mr Eser was more pessimistic and said that neither of these two conditions had been achieved. As a consequence, it now seemed very unlikely that there would be any improvement over last year.

Indeed, the latest data from members confirms that prospects for profitability this year have dropped sharply in the past three months for many carriers. There are exceptions, of course, but in general, the trend is down, though mixed.

"We estimate that, at best, the industry could show a break-even result this year or possibly a marginal profit. At worst, the losses could amount to \$1bn or more."

This contrasts with a system-wide profit by IATA's 144 airlines last year of \$800m after tax, and profit of \$600m on international scheduled services alone.

Mr Eser went on to point out that the possibility of profits depended on what savings on fuel costs actually occurred, and on how traffic growth recovered as the summer progressed.

"On the fuel side, while prices have come down substantially in certain highly competitive supply locations like London, New York and Paris, on the whole the scale of reduction has been far short of the drop in crude oil prices.

"For example, in the 12 months to the end of May, crude oil prices fell by about 55 per cent. Jet fuel prices, however, as reported by members to us, showed an average reduction of

World total international and domestic revenue traffic

(Scheduled services of airlines of ICAO Contracting States)

Year	Passenger-Annual increase (%)	Passenger-km-Annual increase (%)	Freight tonnes-Annual increase (%)	Freight tonnes-km-Annual increase (%)	Mail tonnes-km-Annual increase (%)	Total tonnes-km-Annual increase (%)						
							m	m	m	m	m	m
1976	576	7.9	764,000	9.5	9.3	7.5	21,540	11.2	3,350	4.5	83,390	10.9
1977	610	5.9	818,000	7.2	10.0	7.5	23,630	9.7	3,180	4.8	104,440	7.7
1978	679	11.2	898,000	14.4	10.5	5.7	25,940	3.5	4,270	2.3	118,540	12.6
1979	735	11.1	1,060,000	18.2	11.0	2.5	28,810	2.0	3,420	1.9	128,560	11.7
1980	748	-0.3	1,059,000	2.7	11.1	0.8	29,390	4.9	3,580	7.5	130,980	3.3
1981	752	0.5	1,119,000	2.7	10.9	-1.6	30,890	5.1	3,890	3.1	135,490	3.4
1982	764	1.6	1,142,000	2.0	11.6	6.0	31,540	2.1	3,890	2.1	138,490	2.1
1983	795	4.0	1,187,000	3.9	12.1	5.4	34,980	10.8	4,910	3.4	145,990	5.5
1984	841	5.8	1,271,000	7.1	13.2	9.0	38,490	12.9	6,590	7.2	158,570	8.2
1985	881	6.0	1,360,000	7.0	13.2	-0.7	39,510	-0.4	4,340	0.9	166,570	5.2

Source: ICAO.

only some 20 per cent for the same 12 month period.

"We expect there are still some further savings to come in certain markets which usually react slowly in passing on such reductions, such as Japan."

On the capacity side, airlines have continued to put more seats onto many routes, especially the North Atlantic, despite the sharp slackening in traffic growth. Mr Mike Brown, assistant director of management information at IATA, has said that "the gap between capacity and demand is continuing to grow at a high rate, particularly on the Atlantic, where capacity from North American carriers alone has grown by 20.8 per cent."

The danger facing the airlines is that the windfall of cheaper fuel prices, where they have occurred, could be wiped out by falls in revenue yields stemming from over-capacity.

"If yield dips by one percentage point (industry-wide) profit levels will drop by \$400m," Mr Brown says. Looking further ahead, 1987 could be a little better, but not much.

In Mr Brown's view: "Most carriers will break even, but they will be the lucky ones."

The North Atlantic situation continues to trouble many European airlines, especially those in the UK for they depend on that route substantially for much of their revenues. British Airways earns about a quarter of its revenues from North Atlantic operations, British Caledonia over 30 per cent and Virgin Atlantic close to 100 per cent.

In the early summer, the

fears of terrorism following the US bombing of Libya, fears of radiation in Europe following the Chernobyl leak, a decline in the value of the dollar, but also a major campaign by the US domestic travel trade for "stay in America" holidays, all combined to depress US-originating Atlantic traffic.

Efforts by the UK and European governments, airlines and travel trade have been only partially successful. While by mid-July there were reports of an upturn in bookings on the North Atlantic, they could not compensate for the damage already done to airlines' balance sheets in the early summer months, and at best airlines will show reduced profits for the summer if not actual losses.

The impact could be serious for some airlines, which depend on summer profits to see them through the bleaker winter months and to produce overall profits for the financial year.

For example, without this summer income, British Airways, in its run-up to privatisation, could be in some difficulty. Its 1985-86 balance sheet showed that in the second six months to end-March, it only broke even, so that its overall profit for the year was due entirely to the profit it earned in the summer of 1985.

However, in recent weeks BA has shown more optimism, with Mr Colin Marshall, chief executive, reporting that "there have been a number of indications from around the world that the worst may be over, and that our business is returning to normal."

Although in the short-term

with associated heavy interest charges, versus leading are already being debated long and hard in many airline boardrooms, and it is certain that more and more airlines will opt for the latter method of financing their fleets in the years immediately ahead.

The growth of leasing to meet the airlines' own expanding fleet requirements for jets that in themselves become over more costly (one new Boeing 747 jumbo jet, now cost well over \$100m) is one of the major recent developments in the aerospace industry.

In some cases, these leasing organisations have grown so large and powerful that they can place some of the biggest orders ever seen for new aircraft—see example being the recent \$2,750m order by the GPA Group of Shannon for over 100 jet airliners from Boeing and McDonnell Douglas.

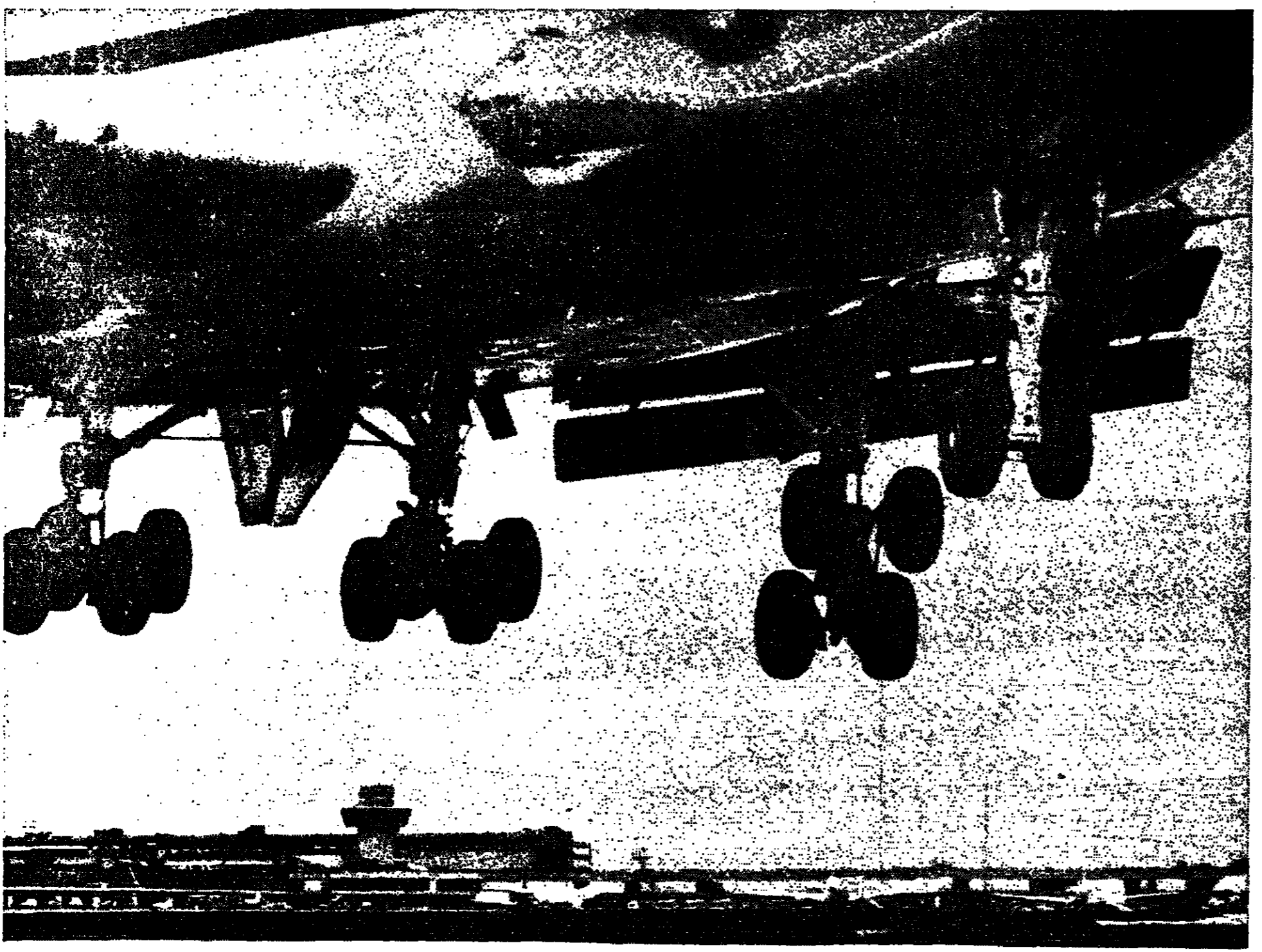
It seems likely through the years ahead that fewer and fewer airlines will resort to buying aircraft, with the attendant heavy burdens of interest on loans from banks and other financing institutions, and will turn more to leasing. Debt repayments by the airlines have been increasing, from around \$1bn in 1980, to reach \$1.7bn in 1984 and \$1.6bn in 1985, with a comparable figure likely for the current year.

It has been estimated by the IATA that depending on the rate at which traffic grows, the IATA member airlines alone will need to invest between \$1,500m and \$3,000m in new equipment over the next decade, which in turn indicates that they will need to earn average operating profits before interest of at least 7.5 per cent which, allowing for tax, rises to 10.5 per cent.

The airlines are currently not earning that level of profit. In fact, as IATA says, their return on investment and turnover is totally inadequate for the massive re-equipment programme before them. Many airlines are already over-borrowed, and will face increasing difficulties in finding additional finance to meet their needs.

Leasing, rather than buying, is now probably the only way out of their problems unless their governments come to their aid with preferential loans.

Michael Doms



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This comparison, extracted from a radar screen, shows the dramatic improvement in bearing accuracy obtained with the Cossor Monopulse System.

Left: An aircraft track obtained with conventional SSR. Right: The same track obtained by Cossor Monopulse.



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Aerospace 3

Airliners

Re-equipment tide flows strongly

THE WORLD'S major airliner manufacturers are having a good year, as airlines progressively phase out existing ageing fleets and acquire replacement aircraft, or re-equip to meet the substantial traffic growth anticipated between now and the end of the century.

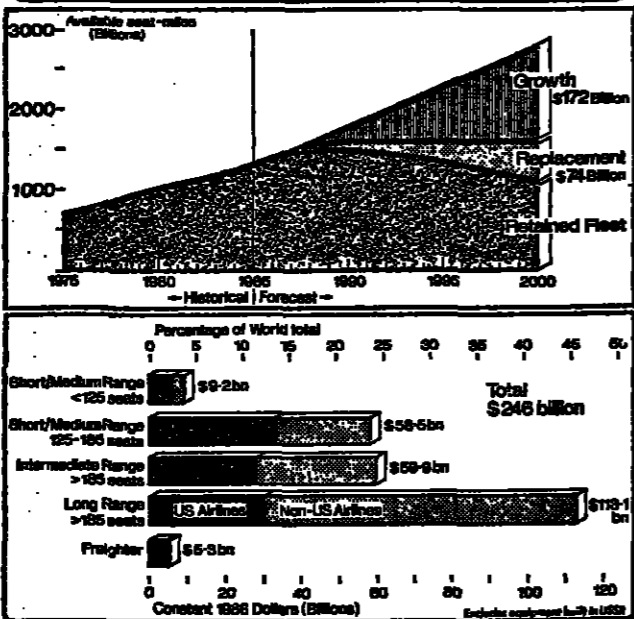
This re-equipment tide is flowing despite some airlines' cash difficulties stemming from currently poor financial results. But the fact that they are still able, and anxious, to acquire new equipment indicates both their own determination not to be left behind by the competition, and the confidence of the leading institutions in the air transport industry's long-term viability.

Boeing, the world's biggest airliner manufacturer, logged new firm orders for 242 aircraft in the first six months of this year, worth \$12.6bn, compared with last year's first six months' total of 77 aircraft, and the full 1985 total of 390, worth \$14.96bn.

Both Airbus and McDonnell Douglas, Boeing's rivals, have also done well, while there has also been a steady inflow for smaller, commuter and regional types of airliners, such as the SAAB 340, now being delivered, and the new Fokker F-100 and F-50, which is under development.

With the second half of the year, customarily a stronger period for new orders than the first half, and with many airlines currently known to be negotiating major new commitments, it seems likely that for

World Market for Jet Airliners (to 2000)



the whole of 1986, the manufacturers cumulatively will match, if not exceed, last year's total of 828 new jet airliners alone firmly ordered, worth about \$25bn—with orders for turbo-propeller commuter and regional airliners additional to these. All the major manufacturers are confident that air traffic growth will continue, despite current financial problems for

Boeing, for example, believes that between now and the year 2000, the airlines will spend up to \$245bn on new jets, of which \$172bn will be for traffic growth, and \$74bn for replacements.

Boeing bases these estimates on a world average annual passenger traffic growth rate of about 5.5 per cent over that period. It puts the number of aircraft involved at about 5,656 jets, which after allowing for retirements of 2,920 means a net gain of 2,740 jets from the end-1985 fleet total of 6,690 to a total of 9,430.

McDonnell Douglas suggests that up to the end of the century, a total of about 5,435 new jet airliners will be needed, worth about \$250bn, and it also believes that passenger traffic will grow by an average of about 6.3 per cent a year.

Airbus Industrie, whose forecasts run to the year 2005, suggests a more optimistic total of close to 9,000 new jet airliners, which, after discounting existing orders and fleet retirements means a total jet fleet by that time of some 7,550 aircraft. It also bases its forecasts on a broad average annual passenger traffic growth of about 5.5 per cent a year.

To meet these forecasts, all the "big three" jet airliner builders now have major new programmes under way, to meet different sectors of the market.

At the upper end of the scale, Boeing is now selling to airlines worldwide the latest version of its 747 Jumbo, the



Interior of the Fokker F-100 incorporates the most up-to-date ideas on cabin comfort

very long-range Series 400, although it also continues to offer the stretched upper deck Series 300 and the popular Series 200. Boeing now dominates the long-range airliner market, with nearly 730 747s of all types ordered, and more than 640 delivered.

Competition comes from the Douglas Aircraft Division of McDonnell Douglas, with its tri-jet DC-10, of which over 414 have been built and 429 ordered, but this group is now offering the world's airlines an advanced technology derivative called the MD-11, also a tri-jet. Douglas is now canvassing launch customers, and hopes to be able formally to launch the MD-11 into production around the turn of this year.

Airbus is also now planning to enter the long-range airliner market, but with an aircraft of smaller capacity than either the Boeing 747 or the Douglas MD-11. Airbus believes there are many routes worldwide that need long-distance transport but do not have the traffic densities to justify the use of such big jets as 747s or MD-11s.

Accordingly, it is offering the airlines its new A-340 design, a plan for a 260-310 passenger four-engined Airbus that will be built alongside another new venture, the A-330, a twin-engined, short-to-medium range aircraft, also seating about 260 to 310, according to configurations used.

By using a common fuselage and common wings and systems, Airbus believes that it can keep the overall development costs

of both aircraft down sufficiently to enable it to compete fiercely with Boeing and McDonnell Douglas.

Here, too, Airbus is looking for launch customers, and hopes to be able formally to launch both these new ventures around the turn of this year.

Earlier this summer, at the Hannover air show, there were suggestions that Airbus and Douglas might collaborate in the development of a joint A-340/MD-11 type of aircraft for the long-range routes. But although it was not denied that there had been some discussions, their significance was played down by both sides.

It is possible that such notions may be revived at the forthcoming Farnborough Air Show, and there is little doubt that collaboration of such a nature would benefit both companies.

This would ease their development costs, and widen their ultimate markets, and offer formidable competition to Boeing. The latter has plans of its own for a "long/short" route aircraft—a new derivative of the 747, called the ADV or Advanced Development Variant, capable of flying up to 7,000 nautical miles with about 300 passengers.

While Airbus and McDonnell Douglas are still prepared to go it alone on their respective ventures, it clearly would make economic sense for them to collaborate and thus avoid splitting the market three ways for these long-range, lower-density aircraft, to the detriment of all.

McDonnell Douglas cannot, under US anti-trust laws, collaborate with Boeing, and there are strong precedents for such international collaboration—Boeing itself has a 25 per cent equity stake from the Japanese aerospace industry in its new 737 prop-fan transport, and actively seeks overseas partners on all its other transport aircraft programmes.

Below the long-range market for both high-density and low-density traffic, the entire market is a ferment of activity. Airbus is pressing ahead vigorously with its A-320 150-seater twin-engined aircraft, which is competing directly with Boeing's own 737-400 and 737-300, and the McDonnell Douglas MD-80 series of twin-jets.

Coming along for the early 1990s is the new Boeing 737 twin-engined 150-seat prop-fan airliner, using the revolutionary new power-plants discussed elsewhere in this survey, and the smaller Douglas MD-91X, also a prop-fan but designed for the smaller but equally large market for aircraft seating 100 to 110 passengers.

Below these, there are ideas for smaller prop-fan airliners from such manufacturers as Messerschmitt-Bölkow-Blohm and Dornier of West Germany, that could revolutionise the large market for commuter and regional transports currently dominated by conventional turbo-propeller airliners.

Just how far this prop-fan revolution will eventually go remains to be seen. But if the claims now being made for it

—such as reductions in fuel consumption of up to 40 per cent compared with current generation turbo-fan engines, lower noise, and less pollution—are proved, it seems clear that the jet engine will have a serious rival through the 1990s and into the next century.

This will not mean the end of the jet engine as we know it, however. The massive investments already made, and likely to be made through the rest of this century in such jet airliners as the Boeing 747, 737, 767 and 777, Douglas MD-11 and MD-90, and the Airbus A-320 and forthcoming A-330 and A-340, are not likely to be thrown overboard.

While all the major jet airliner builders will be bound to explore the possibilities of the prop-fans, and at some stage in the future may even offer variants of their existing jet aircraft with prop-fan engines, the jet airliners now under development today will remain in service for as much as 20 years or more.

What cannot be overlooked, however, is that massive investments are also being made in prop-fan developments, and engine builders as well as the airframe manufacturers will be seeking returns on those outlays.

The pressures on airlines to convert to prop-fans will be immense, and the rivalry between the two types of propulsion will be formidable indeed.

Michael Donne



Boeing's latest Jumbo, the very long range 747-400 now ordered by British Airways

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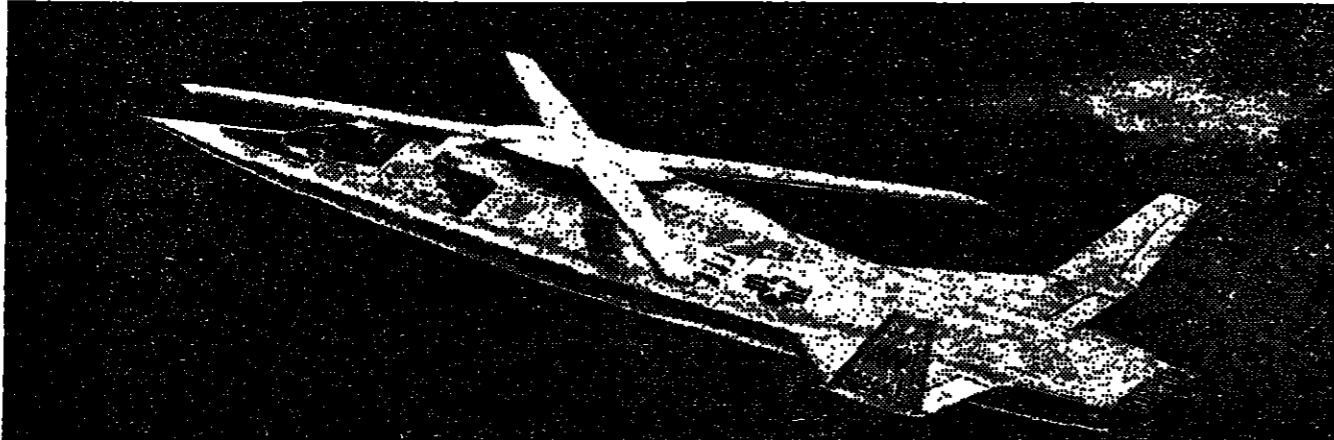
Aerospace 4

Helicopters

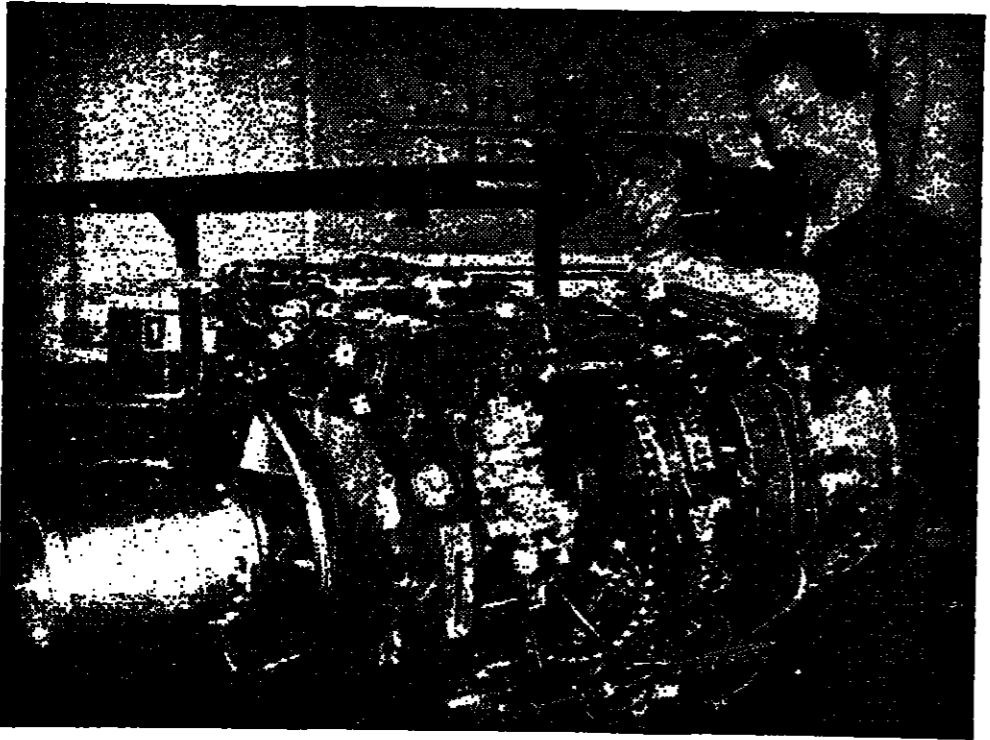
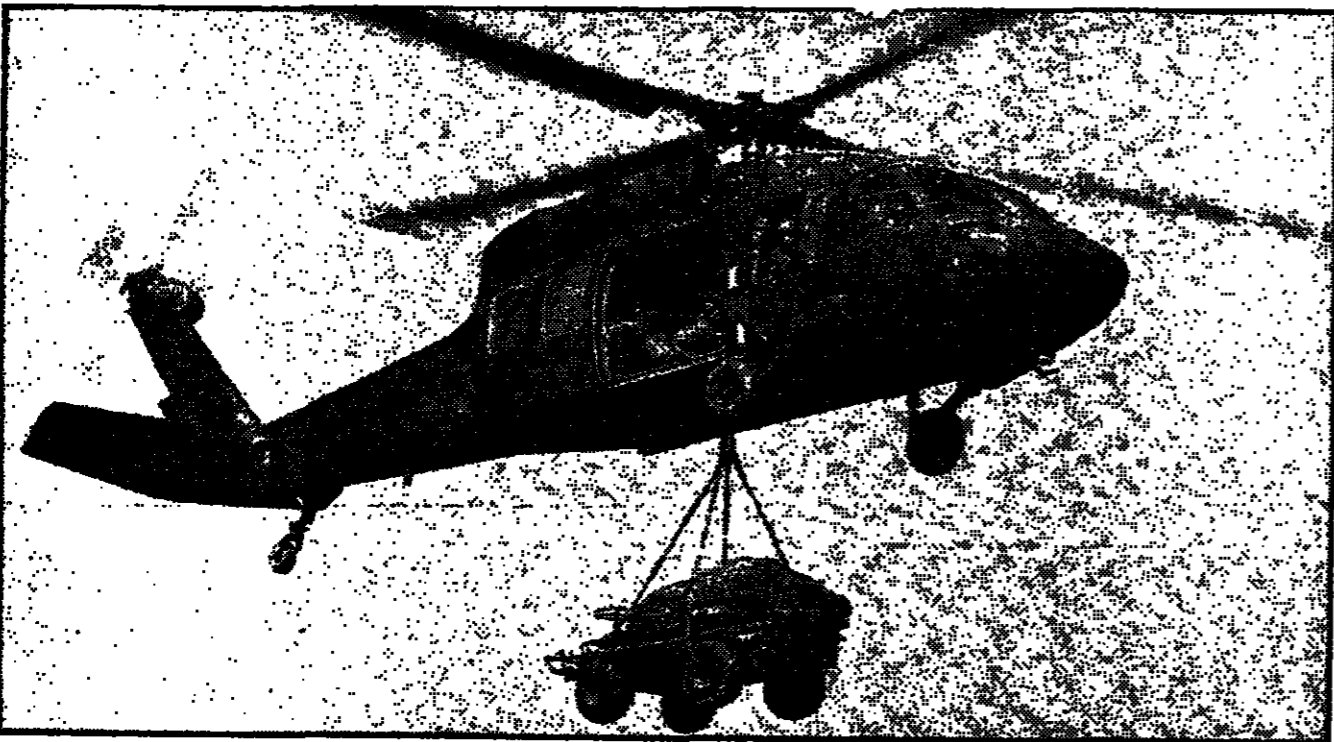
Costs cut through collaboration



The Westland Lynx 3 helicopter set a new world helicopter speed record of 249.10 mph earlier this month, beating the previous record of 228 mph held by the Soviet Union



The Sikorsky X-wing experimental rotorcraft was rolled out earlier this month in the US. The artist's conception shows how an eventual adaptation of the concept to a fighter aircraft may look



Above: the US Army/Sikorsky UH-60 Black Hawk. This versatile helicopter, made in a number of versions including transport, combat, and search and rescue, could be ordered by the UK as an Army tactical transport and support aircraft. This prospect is increased by this year's acquisition by United Technologies (Sikorsky) of a financial stake in Westland.

Left: Rolls-Royce and Turbomeca of France have jointly developed a major new helicopter engine, the RTM-322, which could be used in a wide range of rotorcraft in the years ahead. Its "core" could also be adapted for other types of engine.

DESPIITE difficulties in world markets stemming from a short-term decline in civilian orders, especially from offshore oil customers, and a hiatus in military buying while major new programmes are established, particularly in the US, the long-term prospects for helicopters remain bright.

The exceptional versatility of this type of aircraft guarantees that between now and the end of the century it will remain in demand. However, the high costs of development and manufacture are already ensuring that the major new programmes now evolving are essentially collaborative, both on an inter-company basis (as in the US) and on a wider international basis (especially in evidence in Western Europe).

This collaboration is designed to damp down to some extent the over-capacity problems that have bedevilled the helicopter industry in recent years, giving rise to fierce competition for sales.

Even so, it seems likely that the battles for world markets will be undiminished in ferocity, and all eight major manufacturers — Bell, Boeing-Vertol, Sikorsky and McDonnell Douglas in the US, Westland in the UK, Agusta in Italy, Aerospaciale in France and Messerschmitt-Bolkow-Blohm in West Germany — will be operating from now on in a much tougher environment.

So far as Westland is concerned, following the financial reconstruction earlier this year when Sikorsky of the US and Fiat of Italy acquired financial stakes in the company, the task is now to rebuild its industrial base.

Mr Hugh Stewart, group chief executive of Westland, points out that although United Technologies of the US (parent of Sikorsky) holds about 21.4 per cent of the nominal value of Westland shares and holds about 18.5 per cent, in terms of voting shares UTC holds about 9.5 per cent and Fiat about 5.3 per cent.

"Thus, in terms of control, the combined UTC/Fiat holding is now approximately 14.8 per cent," Mr Stewart says.

Currently, the Westland business environment is complicated by three factors: the aftermath of the financial reconstruction; the effects of reductions in home defence spending by the Ministry of Defence; and current over-capacity in world helicopter manufacturing resources.

The main consequence of the reconstruction is that the US Sikorsky Black Hawk, called the WS-70 by Westland, is now part of the Westland's product line. This has the potential for manufacturing work to be carried out in the UK for Sikorsky, the manufacturer in whole or in part of aircraft sold by Westland to UK or overseas customers, using the Rolls-Royce/Turbomeca RTM-322 engine.

An important customer, not yet committed for the WS-70 remains the Ministry of Defence.

Westland sees the Ministry of Defence as continuing to be a major customer, accounting for 60 to 70 per cent of all helicopter sales by the company. Over-capacity in helicopter manufacturing continues to be a problem. In the US, the major manufacturers are in a stronger position, substantially supported by large-scale military orders, which helps to reduce costs through large production runs. On the Continent, the major manufacturers are also substantially Government-supported.

Nevertheless, Westland believes that it has some outstanding aircraft to offer — the EH-101 Sea King replacement, with a civil variant also planned; the WS-70 derived from the Sikorsky Black Hawk, which is effectively a new high performance tactical helicopter, especially when fitted with the new RTM-322 engine; and the Super Lynx, an outstanding

light naval helicopter for general-purpose duties.

The Sea King itself, one of Westland's mainstays in recent years, is also still an active programme with aircraft currently being supplied to India for anti-submarine warfare work.

The company's biggest venture for the immediate future, however, is the EH-101, developed under the international agreement with Agusta of Italy through the jointly-owned EH Industries. The first EH-101 will be rolled out in December, with first flight next spring. Nine flying prototypes are to be built, and eventually some 800 aircraft are envisaged. Costs could be as high as \$650m for joint development, and \$350m for UK production alone.

The EH-101 — designed for all-weather day and night operations in a wide range of anti-submarine, anti-surface ship, search and rescue, replenishment, airborne early warning and electronic counter-measures roles — has long endurance and can operate from both land and ship-borne bases.

The civil market is regarded as especially important for the EH-101, primarily with opera-

land sees no reason why it should not at some stage participate in plans for the international development of a multi-role helicopter, the NH-90, for the 1990s, if that venture matures. So far, it is only in the feasibility study stages, between the UK, France, West Germany, Italy and Holland, and no decisions to go further into project definition have yet been taken. But it could yet prove to be a major project for the 1990s.

Also, Westland is involved with Agusta of Italy on the plan to develop a new Light Attack Helicopter (LAH), from the current Agusta A-129 Mangusta helicopter, probably with the participation also of Holland and Spain.

The fact is that, despite the financial and political difficulties of the latter part of 1985 and early into 1986, Westland has survived as a manufacturing entity in the world helicopter industry. Its present management intends that it will stay in that league.

It is justified in that view in its estimates of future world helicopter markets. Despite difficulties in the past few

years, the longer-term future is seen as bright. Although civil markets are still slow to develop, eventually it is believed they will match, if not exceed, military markets.

For the immediate future, the latter are the more promising. Westland sees overall markets (outside the US and also the Soviet Union and other Eastern bloc countries) amounting to more than \$20bn for military helicopters of all kinds, covering over 9,000 aircraft, up to the end of this century.

These include up to 1,500 naval helicopters worth about \$5bn in the Lynx/Sea King/EH-101 category; 3,100 aircraft worth \$10bn in the army support category; some 2,000 aircraft worth \$4bn in the Army attack helicopter class; and about 2,500 worth \$1.5bn in the light military class.

Many of these fields are likely to be dominated by exports of US helicopter types, however, especially if such major US programmes as the LHX (Light Helicopter Experimental) fully mature. Up to about 5,000 of these aircraft are likely to be ordered through the rest of this century, making it the most lucrative helicopter programme anywhere in the Western world.

Two major groups are bidding for the contract — Boeing Vertol and Sikorsky Division of United Technologies, against Bell Helicopter Textron and McDonnell Douglas Helicopters.

Many other major equipment, component and auxiliary suppliers in the US aerospace industry are lining up behind one or another of these two teams, and the final competition will be one of the most

ferce procurement battles ever fought in the US.

The Boeing Vertol/Sikorsky team also includes Martin Marietta, Northrop, Rockwell International, Spigot, TRW Military Electronics Division, Hamilton Standard and Waddinghouse Defense and Electronics. The Bell/McDonnell Douglas team includes Honeywell, Hughes Aircraft, Sperry Corporation, Texas Instruments and others.

On each side the line-up is formidable, across the entire spectrum of aerospace technological disciplines.

Current plans envisage a decision on full-scale development by the US Army during 1987, with first flight of the winning helicopter in 1991. If Sikorsky and Boeing Vertol win the contract, there is every prospect of some LHX work coming to Westland in the UK.

The Rolls-Royce/Turbomeca RTM-322 engine, already mentioned, represents a major bid to win massive engine markets in helicopters both at home and overseas.

Fight trials of this engine (which could also be adapted for other uses) began earlier this summer in a Sikorsky S-70C aircraft, the civil variant of the US military Black Hawk.

Potential applications for the RTM-322 include both the US Black Hawk and Sea King helicopters now in service with the US armed forces, the Anglo-Italian EH-101, the Westland 30, the prospective European NH-90 Nato helicopter for tactical transport and other duties, and a single-engine version of the Italian Agusta A-129 for anti-tank and other roles.

The RTM-322 programme is funded by Rolls-Royce and Turbomeca, with support from both the UK and French Governments.

The RTM-322 engine is also a possible candidate for re-engineering the McDonnell Douglas AH-64 Apache helicopter, now used extensively by the US Army. This engine fits beautifully into the AH-64, according to McDonnell Douglas Helicopters and would increase its power from 1,700 shp to 2,000 shp.

Among other major helicopter developments that could transform the future of rotary-winged flight is the recent US Naval Air Systems Command decision to place a \$17bn seven-year contract for the joint Boeing Vertol-Bell Helicopter Textron team for the development of the V-22 Osprey tilt-rotor aircraft.

This machine is designed to take off and land like a helicopter but also to fly like a turboprop aircraft in conventional forward flight, reaching speeds of more than 300 mph and altitudes close to 30,000 feet. It is intended for both military transport and for civilian applications.

Initially, the development programme calls for the first flight of the V-22 by June, 1988, with production deliveries beginning in December, 1991, to the lead service, the US Marine Corps.

Current plans call for the eventual production of 1,215 Ospreys for the US Marine Corps, Navy, Army and Air Force, for wide-ranging roles including combat assault, support, search and rescue, anti-submarine warfare and special support operations.

Future commercial versions of the Osprey could efficiently support long-range offshore oil exploration activities and permit fast, effective city centre to city centre operations, by-passing congested airports and ground traffic delays. Such airline-style versions of the mid-1990s.

US aviation analysts have estimated that the world market for commercial tilt-rotor aircraft now ranges from 4,000 to 10,000 aircraft up to the end of this century.

The battle for world markets by the eight leading makers is undiminished in ferocity

tions in the offshore oil industry in mind, in such areas as the North Sea, the Canadian Arctic and South America and Antarctica. But it is believed that opportunities will also develop in the civil commuter market and elsewhere, so that eventually between 300 and 400 civil EH-101s will be built, or almost half the total market for the aircraft.

A possible further variant is the Utility model, for tactical use by land forces, which could generate a market for 250 or more aircraft. Westland says that with the EH-101 it is making a vigorous bid for civil helicopter markets worldwide.

Another possible Westland civil venture is the W-30/300, a version of the original W-30 transport helicopter, of which in turn other versions are in production for the Helicopter Corporation of India and in service with Omni-Flight of New York and British Airways Helicopters (recently sold to Mr Robert Maxwell). The W-30/300 has already flown, but it is not intended to manufacture it speculatively.

Mr Hugh Stewart comments that "if we find a customer who wants the Westland W-30/300, and the order is big enough to justify launching the aircraft, we will launch it and that does not in any way conflict with the Black Hawk."

"The Westland 30 is the less expensive end of the market and the Black Hawk is at the more expensive end, so I don't think there is any real conflict between the two aircraft. If we look at them as though we can do good business, we will make them."

Looking further ahead, West-

World market for helicopters (1987-96)

Sector	Weight class				Total
	Light	Inter-mediate	Medium	Heavy	
US Government	—	199	2,315	576	2,975
Foreign military	2,295	1,959	1,729	335	6,139
Worldwide civil	3,109	1,399	229	5	4,715
Total	5,395	3,339	4,115	890	12,299
Source: Sikorsky Aircraft	\$5.1	\$10.9	\$33.7	\$8.1	\$47.8

Michael Donne

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New shapes

# Planning for the Mach 5 airliner

WITH CONCORDE now well into its eleventh year of regular scheduled supersonic air services, and likely to last until the end of this century and well into the next, there have been few suggestions for the development of a possible direct successor.

Although from time to time designs of potential "Mark Two" Concorde have emerged — the most recent being a design study earlier this year by Aerospatiale of France, one of the original Concorde manufacturing partners — the potentially high costs involved coupled with the limited market, have deterred governments, aerospace manufacturers and airlines alike from committing themselves to such a development.

Now, it seems likely that the trend of research into very high-speed aircraft on both sides of the Atlantic could accelerate, to the point where a big leap forward is made. This would bypass any second-generation supersonic airliner, and move instead directly to a new type of even faster "hypersonic" aircraft — that is, capable of flying at more than five times the speed of sound (Mach 5, or nearly 3,400 mph), against Concorde's twice the speed of sound (Mach 2, or about 1,300 mph).

Such aircraft would fly so high (well over 100,000 feet) that they would be close to the fringes of the Earth's atmosphere. From such hypersonic transports, it would not be difficult to develop aircraft that would have the capability of entering low-Earth orbit on ballistic style trajectories to give them even faster journey times.

From that in turn it would be feasible to develop what

effectively would be "aerospace planes" or "transatmospheric vehicles," that could not only be used as transports but also as workhorses in orbit, for surveillance or even satellite launching, while still using runways for taking off and landing like conventional aircraft.

Current research is involved with both forms of vehicle — hypersonic and transatmospheric.

In the UK it is concentrated on the "Hotol" — for Horizontal Take-Off and Landing — a true transatmospheric vehicle, designed to use runways like an aircraft but also to soar into orbit like a spacecraft.

In the US, although research for a long time was widely spread, covering not only hypersonic transport ideas but also transatmospheric vehicles, it has now been officially focused on hypersonic transports through the National Aerospace Plane (NASP) concept.

This, however, could eventually devolve into a family of vehicles, including a true transatmospheric vehicle for reducing the costs of putting spacecraft payloads into low-Earth orbit by the end of this century at cheaper rates than the current Space Shuttle can provide.

As the US Defence Department has stated: "If the new research programme is successful in demonstrating the necessary technologies, an entirely new family of aerospace vehicles will be possible, able to cruise within the upper atmosphere at hypersonic speeds, or ascend directly into orbit."

As a space launch vehicle operating from conventional runways, the fully reusable and single state aspects of the NASP are believed to produce

very large reductions in the cost of placing payloads in orbit.

The UK's Hotol venture, now the subject of a £2m study by British Aerospace and Rolls-Royce funded by the Department of Trade and Industry, is a tubular-looking design for a spacecraft that could take off from normal runways, boost itself into near-earth orbit to perform various missions in space, such as satellite launching, and return to Earth to land like a conventional aircraft.

Although initially intended to be unmanned, the current studies also include the possibilities of a manned variant, with a pressurised cabin replacing the cargo bay.

The Hotol would be fuelled for flight in space by liquid hydrogen and liquid oxygen, although air-breathing engines would also be used for its conventional take-off and landing roles. Because the Hotol is currently the subject of Government-funded "proof-of-concept" studies, details of its design and its power-plants are not revealed, although the latter are claimed to be far in advance of anything yet attempted.

It is suggested that Hotol would have a take-off speed of about 290 knots after a runway roll of about 7,500 ft. The vehicle would be flying supersonically after two minutes, with an angle of climb of about 24 degrees.

It would be clear of commercial air traffic after 4.5 mins (40,000 ft height), and would reach a speed of five times that of sound (Mach 5) after nine minutes' flight. At a height of about 90 km, it would reach orbital velocity, and thereafter its main engine would be switched off so that

it could coast up to an operating height of about 300 km.

A typical mission duration in orbit would be about 50 hours, with position and altitude changes being made by an "orbital manoeuvring system" (OMS). At the end of that time, the OMS would slow the Hotol down, to enable it to return to Earth at a speed slower than that of the US Space Shuttle, for its eventual landing back at its base, or at some other specially-designated runway.

In its unmanned configuration, Hotol would be remotely controlled by artificial intelligence and robotics systems, but in the manned configuration, the crew would be in command, as with the Space Shuttle.

It is claimed that Hotol will reduce the costs of putting payloads into low Earth orbit by a factor of five, and could be as much as halve the costs of putting payloads into higher orbits, such as those that geosynchronous satellites (for example, telecommunications satellites) normally use.

This economy of operation, coupled with quick reaction and a rapid turnaround capability, will enable Hotol to compete realistically for about 75 per cent of the commercial market for launch capability from the year 2000 onwards.

Moreover, it is also claimed that because the Hotol technology is forward-looking, with ample potential for development beyond the cheap and effective spacecraft launcher which is envisaged at present, it could be eventually developed into a commercial transport, capable of passenger flights from Europe to Australia of about one-hour's duration.

At this stage, the progress

being made in the Hotol "proof of concept" studies is not revealed. But at the end of the first six months of these studies, costing an estimated £750,000 shared by the Government through the British National Space Committee and by British Aerospace and Rolls-Royce, the position will be reviewed. If the studies show significant promise, they will be continued.

If the Government is convinced that Hotol has a practicable future, and would not be unduly expensive, further development studies would probably be authorised. Eventually, however, it seems likely that international collaboration on the venture will be sought, primarily in Western Europe where there is already considerable interest in it.

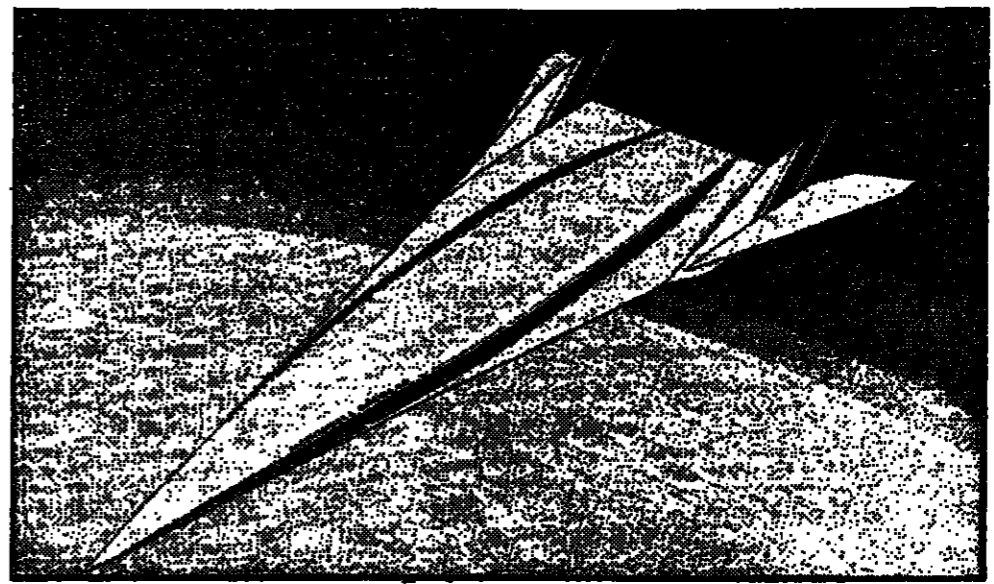
In West Germany, studies into possible future hypersonic flight research vehicles have also been initiated, with a view to determining whether these provide alternatives to the development of the French-inspired Hermes manned reusable spacecraft, planned for launch in 1995, which is similar to smaller than the US Space Shuttle's Orbiter spacecraft.

One such study is by Messerschmitt - Bolkow - Blohm and ERNO, called Horus (a manned but pilotless Hypersonic Orbital Research and Utilisation System), which would be larger than Hermes. Both Hermes and Horus are intended for launch aboard the advanced European Ariane 5 launcher rocket, but both would land back at base like aircraft.

Whether Hermes and Horus are overtaken by Hotol, or all these ideas come together into one transatmospheric vehicle or "aerospace plane" remains to be seen. But what is clear is that not all of these ideas can be financed in Western Europe, and that the UK could never go ahead with Hotol alone. At some stage in the near future, a major debate on which venture goes ahead in Western Europe, and with whom, must occur.

In the US, work has begun on the X-31 National Aerospace Plane (NASP), a project for a hypersonic (over Mach 5, or nearly 3,400 mph) vehicle for service around the end of this century, that would be capable of both military and commercial operations.

In the initial phase, the Department of Defence and the National Aeronautics and Space



A McDonnell Douglas concept of an "Aerospace Plane" which would be capable of flying at five times the speed of sound, or nearly 3,400 mph, by the year 2000, if current US ambitions are fulfilled

Administration have awarded seven contracts to US aerospace and engine companies, worth about \$500m over a 42-month period, for what is called "key technology validation."

A joint office has been established by the Defence Advanced Research Projects Agency (DARPA), in conjunction with the US Air Force and US Navy and NASA, at Wright-Patterson Air Force Base, Ohio, to manage the programme, in which the US Strategic Defence Initiative Organisation is also involved.

General Electric and Pratt and Whitney, the two main US aero-engine companies, have received contracts worth about \$175m each to study air-breathing supersonic combustion ram-jet engines, capable of powering the transatmospheric vehicle at very high speeds, while air-breathing engines can still function. Aerojet Tech-

Systems will be associated with General Electric in the venture. Other forms of propulsion, using liquid oxygen and liquid hydrogen, for example, will also be studied for possible eventual use in an orbital flight vehicle, although much work has already been done in this field over many years in the existing US space programme, especially in the development of the Space Shuttle.

Airframe companies gaining contracts worth about \$32m each are Boeing, General Dynamics, Lockheed, McDonnell Douglas and Rockwell International.

They will study configuration designs, and the technology required to develop them. At a

later stage, these companies will be reduced in number through a design competition to produce just two or three airframe contractors for the next phase of the programme.

The letter, probably starting about 1990, will involve embodying the technological knowledge gained in the current phase into an experimental flight-test vehicle, by about 1993, before any final development of a full-scale hypersonic "aerospace plane" begins.

The NASP programme is thus still only in its very earliest exploratory stages, with no clear-cut conclusions as to how any vehicle will eventually look, or precisely what tasks it will eventually perform, or how. That is what the 42 months' technology validation phase now starting intends to clarify.

Mr Robert C. Duncan, director of the DARPA told a US Congressional sub-committee on aviation earlier this summer that the NASP programme was aimed at producing a vehicle that had a "highly integrated engine and aircraft structure," a high-temperature metallic structure designed for many flights, a large, highly-streamlined fuselage with integral fuel tanks, and multiple engines and exhaust nozzles.

Until the manufacturers produce their various designs of the projected NASP, few other details of its size or capabilities are likely to emerge. But some of the manufacturers have already given their own individual ideas.

One is McDonnell Douglas, which earlier this year told the Senate sub-committee on

science, technology and space that the NASP programme could result in a transport aircraft that could fly at more than five times the speed of sound, serving both commercial and military transport purposes.

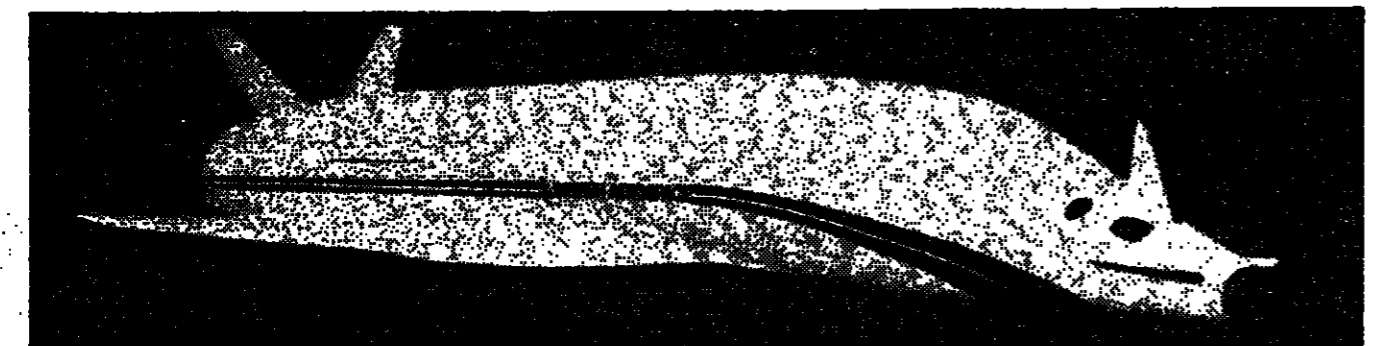
Mr Roger D. Schaufele, vice-president of engineering for the Douglas Aircraft Division, said such a transport, burning methane fuel and using conventional runways for take-off and landing, could carry up to 305 passengers over distances of 6,500 nautical miles, cruising at more than 3,000 mph at heights of over 100,000 feet and bringing Sydney to within two and a half hours of Los Angeles, or Washington within two and a half hours of Tokyo.

Such vehicles could also eventually be used for work in space, delivering payloads such as satellites at much lower costs than the existing manned Space Shuttle transport system.

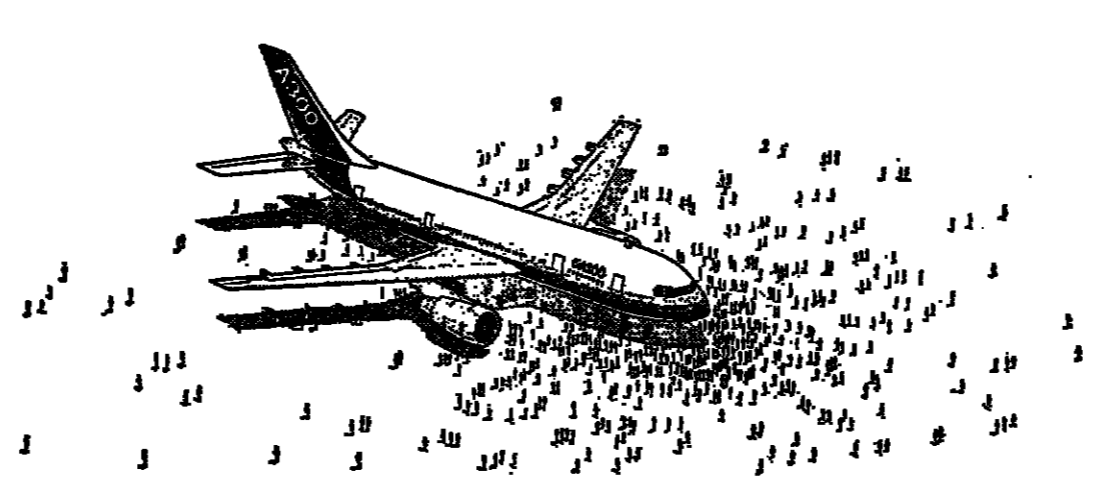
It has been repeatedly stressed in the US that the NASP programme is the key to regaining the substantial lead in aerospace once enjoyed by the US — a reference to US concern at the way in which Western Europe has developed its aerospace potential in recent years.

It is also a reference to the concern now felt in the US at the way in which the Soviet Union has developed a substantial space industry, and is now in a position to build up a commanding lead in manned spaceflight following the recent problems with the US Space Shuttle.

Michael Donne



The British Aerospace/Rolls-Royce Horizontal Take-Off and Landing (Hotol) design for a transatmospheric vehicle is now being studied under a joint financing venture with the Department of Trade and Industry



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## Aerospace 6

## Military aircraft

## Big budget projects beat the curbs

THE WESTERN world's spending on new military aircraft continues to run at a high level, and between now and the end of this century is expected to amount to more than \$500bn.

Despite pressures on defence spending in some countries, the budgets on both sides of the Atlantic will be dominated by some multi-billion dollar programmes for combat aircraft, strategic bombers and transports, some of which have already begun.

Collectively these will spearhead new advanced technological developments in such areas as materials, production methods, design techniques and even new ways of flying, that will have a major spin-off in commercial aircraft manufacture, and give the aerospace industry as a whole a major new impetus as it moves towards the 21st century.

At the same time, the expansion and re-equipping of many Third World air forces is proceeding apace, and will account for a continuing substantial share of the estimated military spending over the next decade and a half.

This growth is being accompanied by an expansion of inter-

est in aerospace manufacturing in many Third World countries that have not hitherto had such industries as their own — partly because of the recognition that aerospace enhances any nation's technological base, but also because such industries can now often be developed through offset deals on military aircraft purchases.

In Western Europe, attention is focused on the new generation of combat aircraft now planned for the 1990s and beyond — the Eurofighter now in the project definition phase by the UK, West German, Italian and Spanish industries, and its rival, the French Dassault-Breguet Rafale in which Holland, Belgium and Norway may also participate.

The French Rafale "technology demonstrator" has already made its maiden flight. The UK's Experimental Aircraft Programme (EAP), delayed for some weeks because of labour problems at British Aerospace's Warton factory and also some minor technical snags has now flown.

Over the next few years, until prototypes of both the Eurofighter and the Rafale become

available, these demonstrators will effectively prove in operation the advanced technologies of the more advanced aircraft to follow.

Project definition of the Eurofighter is now well advanced, and is due to be completed in September. The four nations involved will then submit the project for government approval, and full go-ahead.

The Eurofighter design is for a single-seat, twin-engine, delta-winged aircraft with a small canard fore-wing, for the air-to-air combat role but also capable of fulfilling air defence and air-to-surface (ground attack) roles.

The planned programme comprises about 800 aircraft for the air forces of the four nations (probably about 260 each for the UK and West Germany, about 160 for Italy and about 100 for Spain), with the industrial participation agreed at 33 per cent each for the UK and West Germany, 21 per cent for Italy and 13 per cent for Spain.

A company called Eurofighter Jagdflugzeug GmbH has been set up in Munich to manage the venture, jointly owned by Aeritalia, British Aerospace,

CASA of Spain and Messerschmitt-Bölkow-Blohm. A comparable four-nation joint company (not yet named) will build the new 20,000 lb thrust engine (based on the UK's XG-40 venture) has been formed by Rolls-Royce, Fiat Aviazione, Motoren- und Turbinen-Union and SENER of Spain.

Mr Gerrie Wilcox of British Aerospace is managing director of Eurofighter, and Mr Colin Green of Rolls-Royce is managing director of the engine company.

Eight prototypes will be built to flight test the entire Eurofighter weapons system and it is intended that production aircraft should go into service in 1995.

In technical terms, the aircraft will have a basic mass weight of 17.5 tonnes, and a wing area of 80 square metres, with each engine delivering about 20,000 lbs thrust.

The Air Staffs of the four countries have agreed on the equipment to be used in the aircraft and once formal full go-ahead has been given, it is expected that a vast number of equipment and component suppliers in the four countries will be invited to submit competitive tenders for that equipment, including the avionics.

It seems likely that consortia of companies will be encouraged to undertake specific equipment items, as has been the case with the existing Tornado.

The "technology demonstrators" for both aircraft have now flown the Experimental Aircraft Programme (EAP) in the UK having been delayed for some weeks through industrial problems at British Aerospace's Warton factory.

The Eurofighter will thus provide employment for many thousands of workers throughout the West European aerospace industry, for many years to come, for it will remain in production through to the end of the century and beyond. If exports are taken into account, total production could go well beyond 1,000 aircraft—the Tornado is already close to that figure.

The Eurofighter will come into production in the early 1990s just as Tornado is running out, thus ensuring continuity of military aircraft quantity production costs assured.

The cost of the total Euro-

fighter programme, for research design, development and production has never been given, but estimates have been put at well over £10bn. The initial Experimental Aircraft Programme (EAP) itself has cost the UK industry and Government jointly up to £180m to date, and further EAP funding will be necessary to cover the test programme that will follow the maiden flight over the years ahead.

So far as the Tornado itself is concerned, with another 134 recently ordered from Panavia, bringing total Tornado orders to 933, production of that aircraft is assured through to at least 1992. Without the additional orders, production was likely to end in about 1989. (The additional aircraft include those ordered by Saudi Arabia and Oman, and 34 aircraft for the Luftwaffe for electronic/combat reconnaissance (ECR)).

The new aircraft will be produced at a rate of 4.5 aircraft per month, instead of the current nine aircraft a month, to allow the Tornado production to continue into the 1990s. In the meantime, additional orders for the Tornado are being sought widely, with possible procurement by Turkey and Jordan now under discussion.

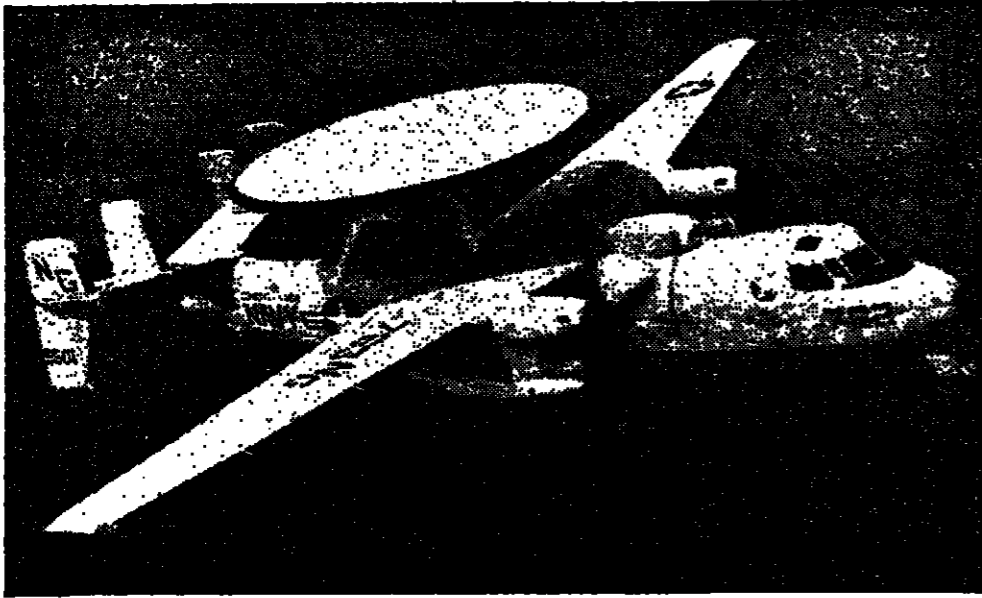
In the US, three major military aircraft manufacturers, Boeing, General Dynamics and Lockheed, have joined forces in a bid to win a \$26bn order for the US Air Force's proposed Advanced Tactical Fighter (ATF). Designed to succeed the existing F-15 fighters built by McDonnell Douglas, it is expected to be one of the biggest defence orders placed by the US Defence Department.

The US Air Force is looking for upwards of 750 aircraft initially at an initial flyaway price of about \$35m per aircraft.

The US Air Force plans to award competitive contracts this October for the demonstration and test programme. The companies involved in military aircraft activity in the US are expected to bid with independent submissions, but the Boeing, General Dynamics and Lockheed team have agreed that whichever of the three wins, all will work on that contract, with the winner as prime contractor and the others



A Lockheed-California Company artist's conception of how the future US Air Force's Advanced Tactical Fighter (ATF) might look



The Grumman E-2C Hawkeye Airborne Early Warning and Control (AWACS) aircraft, for detecting and locating hostile aircraft, in service with the US Navy, has been offered to the UK as an alternative to the Nimrod project. Another Grumman proposal is to fit the Hawkeye's radar and other avionics systems to the Nimrod airframe—the Hawkrod

## Missiles

## Pace of change brings problems

MISSILE development is changing rapidly in response to more complex demands by armed forces. The pace of change has led to problems for manufacturers and the future of some recent projects has been in the balance.

Artificial intelligence is becoming a prime target for aerospace companies developing guided missiles. Ideas on the drawing boards of several missile manufacturing companies include missiles to recognise and attack targets autonomously, operating completely independently of the launch aircraft or ground battery.

Advances in electronics, with smaller, higher-speed semiconductor circuits and more ingenious computer software, have led to these intelligent missiles. The missiles operate alone after launch, but the high cost of their development has led to a parallel move by cost-conscious defence departments towards smaller, simpler and faster hit-to-kill weapons. These make direct hits on targets.

The AMRAAM, advanced medium range air-to-air missile, is one of the new generation of intelligent missiles and is made by Hughes and Raytheon of the US. It is potentially one of the most important guided missile projects to emerge in

recent years. It could become the West's main medium range air-to-air weapon, but has been racked by problems.

The AMRAAM programme has been criticised by the US Congress as too expensive and Congress withheld funds for its development.

Earlier this year, Mr David Packard, the chairman of the Packard Commission which investigated defence systems procurement procedures in the US, described AMRAAM as a "goldplated" weapon, built with too many capabilities at too high a cost.

The commission called for weapons development to be moved from the Defence Systems Acquisition Review Council to a more powerful Joint Requirements and Management Board. This board would seek to increase of the shelf purchasing and stop the "goldplating" of weapons with superfluous technology, the commission recommended.

In tests, the missile has hit a manoeuvring target after being launched from a manoeuvring aircraft.

AMRAAM is supposed to go into full-scale production in April 1987. The first two years of production will be by Hughes and Raytheon. This will be followed by an open competition

for the full-scale production of the missile.

The missile is to enter service with the US Navy and Air Force in 1988. Each missile is likely to cost between \$265,000 and \$275,000 at 1984 prices, with the price based on a purchase of 17,200 missiles for the USAF and just over 7,000 missiles for the US Navy.

AMRAAM may eventually be produced in Europe by a partnership of British Aerospace and GEC in the UK and AEG and Messerschmitt-Bölkow-Blohm in West Germany. The UK and Germany are already working on the advanced short range air-to-air missile, ASRAAM, which may be complementary to AMRAAM.

The US Government has considered requests from the partners for classified data on the missile. The European companies need the data to enable them to build the missiles for a fixed price, as required by the UK and West German Governments.

European production under licence of the missile may be jeopardised by the reluctance in the US to release the complete data on AMRAAM to the European Industrial Team (EIT) to produce the missile in Europe. A possible option is European assembly of components manufactured by Hughes in the US.

The pace of change in missile design is illustrated by a comparison between a current weapon, such as the Hughes HARM, and an advanced missile still at the development stage, such as AMRAAM. Phoenix contains the electronic equivalent of about 4m transistors. AMRAAM contains the equivalent of 7m transistors.

Other innovations include the possible use of coated optical fibres for the secure transmission of data to and from missiles, to make it impossible for an enemy to jam missile control systems. Guidance data for a missile could be transmitted down high-strength optical fibres instead of down the metal wire used at present on several anti-tank missiles.

In Europe, missile manufacturers have had their problems. British Aerospace, for example, has had difficulties with its air-launched anti-radiation missile, Alarm. Anti-radiation missiles are designed to home on the radiation from surveillance radars.

The Alarm missile is being developed in a £200m fixed-price Government contract, but it has problems with its new two-stage solid rocketmotor, the Nutch. This has been developed by Royal Ordnance Explosives division, the Government-owned arms and munitions company, whose sale on the Stock Exchange was postponed earlier this summer.

The original contract for rocket motor development was let by BAe to the former Government-owned Pwepellant, Explosives and Rocket Motor Establishment, PERME, was subsequently taken over by Royal Ordnance, which is still owned by the Government after the abortive attempts to privatise the company with a stock exchange flotation this summer.

The first of 750 Alarm missiles are supposed to be in service with the Royal Air Force late next year.

British Aerospace was unsuccessful in its bid for a lucrative West German contract for anti-radiation missiles. In May, West Germany ordered the Texas Instruments' HARM high-speed anti-radiation missile. West Germany has a requirement for up to 9,000 missiles.

In the UK the development is continuing of portable anti-aircraft missiles able to be launched from the shoulder by one man. The Ministry of Defence has a requirement for a high-velocity missile, to be launched from a light multiple launcher.

The MoD considered pro-

posals from British Aerospace for its Thunderbolt high-velocity missile designed as a close-range weapon for use against heavily-armed helicopters and from Short Brothers of Belfast for the Starstreak high-velocity missile.

At the British Army Equipment Exhibition in June, the Master-General of the Ordnance, Lt-Gen Sir Richard Vincent, said that the Shorts Starstreak missile on an Alvis Stormer vehicle had been chosen to meet the Army's requirement for a high-velocity anti-aircraft missile.

The MoD is considering fitting British Aerospace Sea-View short-range anti-missile missiles to the Royal Navy's three aircraft carriers and some Type 42 destroyers. The company's navy weapons division was awarded a £400,000 contract in the spring to study how Sea-View could be developed with a lightweight launcher.

The company is already developing and test-firing its vertical-launch version of Sea-View for development and production awarded by the Ministry of Defence. The missile is launched vertically so it can target through 80 degrees of its target horizon.

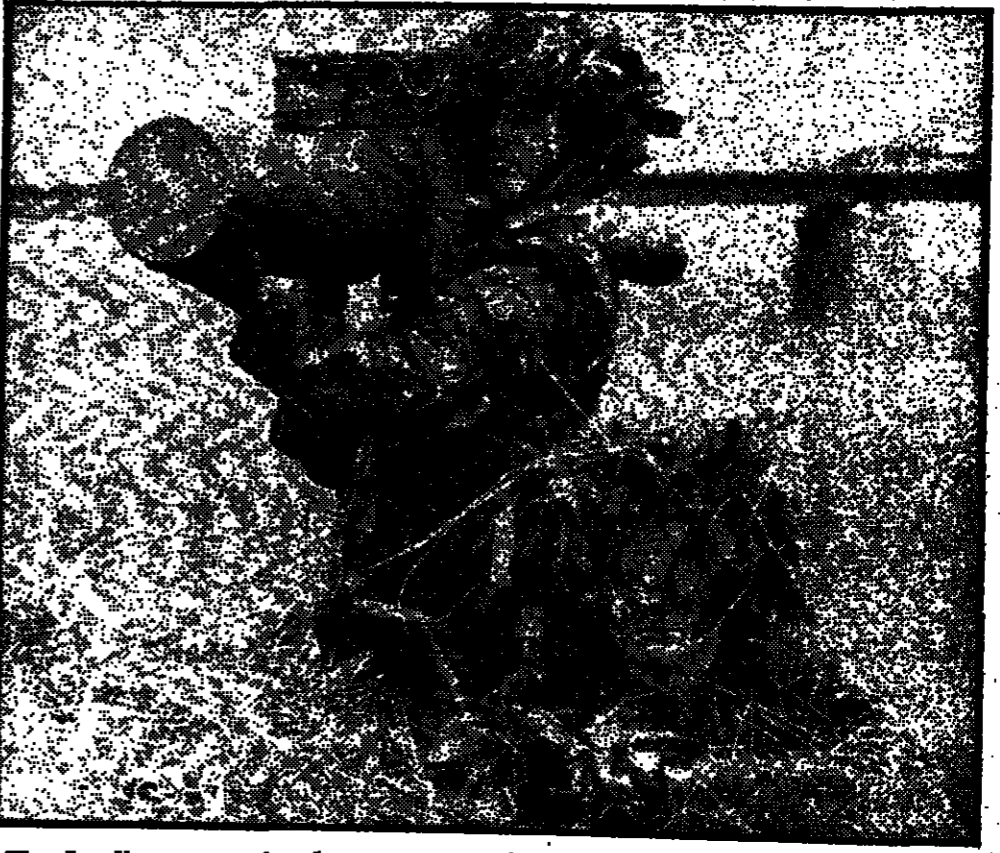
This system is to be installed on the Royal Navy's new type 23 frigates and on the auxiliary oiler replenishment vessels.

British Aerospace received a £440m contract from the MoD for kits to upgrade existing British Army Rapier surface-to-air missile systems to the improved Darkstar standard. Darkstar is a version of Rapier and is equipped with thermal imaging guidance for passive day/night clear weather operation.

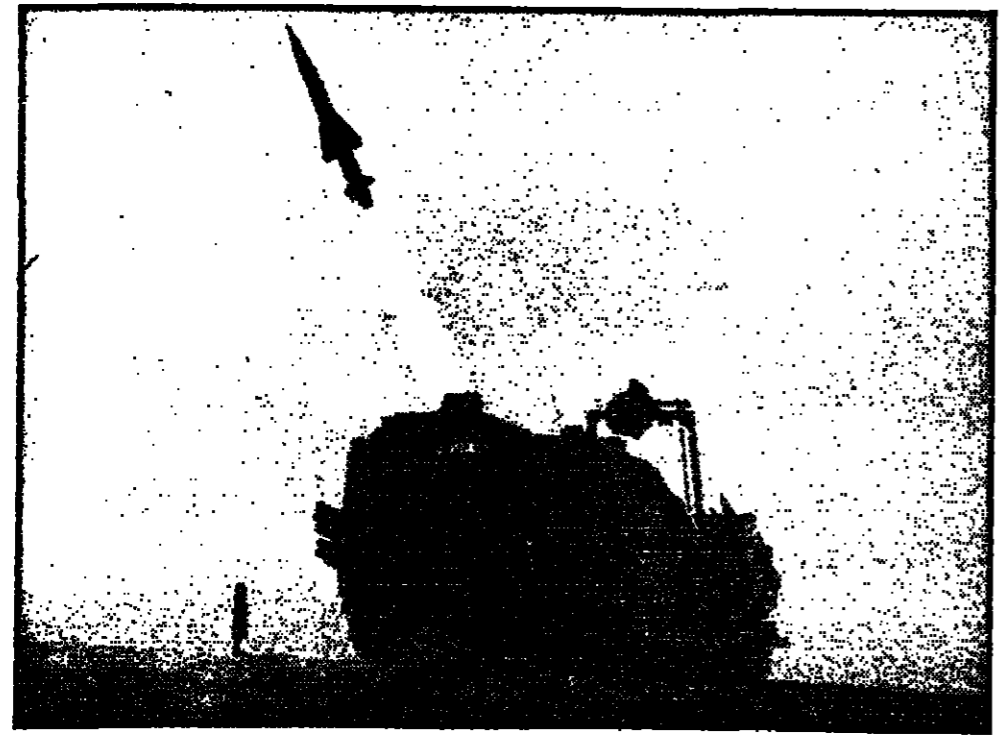
The advances in missile technology have not made gun and shell technology redundant. British Aerospace has a private joint venture development with the Italian defence equipment company OTO Melara, for enabling the trajectory of gun shells to be corrected in flight.

The 76mm gun-fired shells have small rockets, controlled by radio, to give greater accuracy against moving targets.

In the US, the Strategic Defence Initiative Organisation is at the focus of advanced technology developments. The "Star Wars" office is to fund an electromagnetic launcher experiment, involving so-called "railguns," in mid-1988 to demonstrate hypervelocity (over 10 km/sec) and high repetition rate (up to 100 rounds per minute) launching up to a kilogram Westinghouse Marine division is



The Javelin supersonic, close-range portable guided weapons system, made by Short Brothers, is designed to meet the widest range of low-level air defence requirements



The British Aerospace Tracked Rapier anti-aircraft missile, now in service with the British Army

to develop the Thunderbolt experiment in a \$31.5m contract. The US is developing a high endo-atmospheric defence interceptor (HEDI) missile as part of its SDI initiative. The HEDI is designed to be launched from the ground to intercept ballistic missile re-entry vehicles in the upper atmosphere. The first flight tests of the HEDI are expected to take place in 1989.

In the conventional role, the US Air Force is to request \$167m in the 1987 fiscal year for research and development of a second-generation short-range attack missile (SRAM II) for the Rockwell B-1B and the Northrop advanced technology bomber, the "stealth" aircraft. The USAF is studying stand-off weapons under a NATO programme.

The US is developing two intercontinental ballistic missiles, the Peacekeeper, formerly called the MX missile and the small intercontinental ballistic missile (SICBM).

The US Peacekeeper MGM-118 strategic ballistic missile, is to be deployed later this year, when 10 missiles will provide an initial operating capability. The full procurement of 100 missiles is expected to be completed in 1990.

The small intercontinental ballistic missile could be in service with an initial operating capacity by the end of 1992. The first missile is expected to be flight tested in 1989. The base

versions, a ground-to-air missile with a range of about 16 miles and a seven-mile range ship-launched missile for defence against sea-skimming missiles.

Matra, the French manufacturer of guided missiles, has an ambitious programme of development to meet demand in the 1990s. The company has in production, or is developing, about a dozen missiles for the next decade, including the MIC-4 air-to-air missile to be completed by 1990. MIC-4 is to compete for export sales with the AMRAAM and ASRAAM.

France wants to equip its navy with an advanced anti-missile system in the 1990s, with a range of 15 km. Thomson-CSF is the prime contractor for the surface-air anti-missile system, SAAM, and is designing the radar and fire control system for the missile. Matra and Aerospatiale are competing to make the missiles. Aerospatiale is offering its Aster missiles and Matra is offering versions of its SAMAT.

In Canada, the national defence department earlier this year chose a team led by Oerlikon-Bührle and Litton Systems Canada to produce its Canadian \$800m low-level air defence system. The proposals were based on the air defence anti-tank system (Adats) developed by Martin Marietta for Oerlikon.

A European market for several hundred such aircraft could emerge between now and the end of the century.

This FLA study is independent of an industry-based study called FIMA (Future International Military/Civil Airlifters) in which Aerospatiale, British Aerospace, Lockheed and Messerschmitt-Bölkow-Blohm have been involved. McDonnell Douglas of the US also has a study for an Advanced International Military Short Take-Off and Landing Airlifter (AIMSA).

Whether all these ideas can at some stage be brought together in one coherent international Nato programme remains to be seen.

What is clear is that not all of them will ultimately be developed—the demand is not sufficiently great, and the costs would be prohibitive. The most sensible objective would be for the FLA and the FIMA projects to be brought together, under NATO auspices.

If an in-service date of about the year 2000 is postulated, full development would need to be established by 1994, which indicates that firm commitments would need to be taken between then and 1990, which in turn indicates an increasing level of government and aerospace industry interest in such aircraft over the years immediately ahead.

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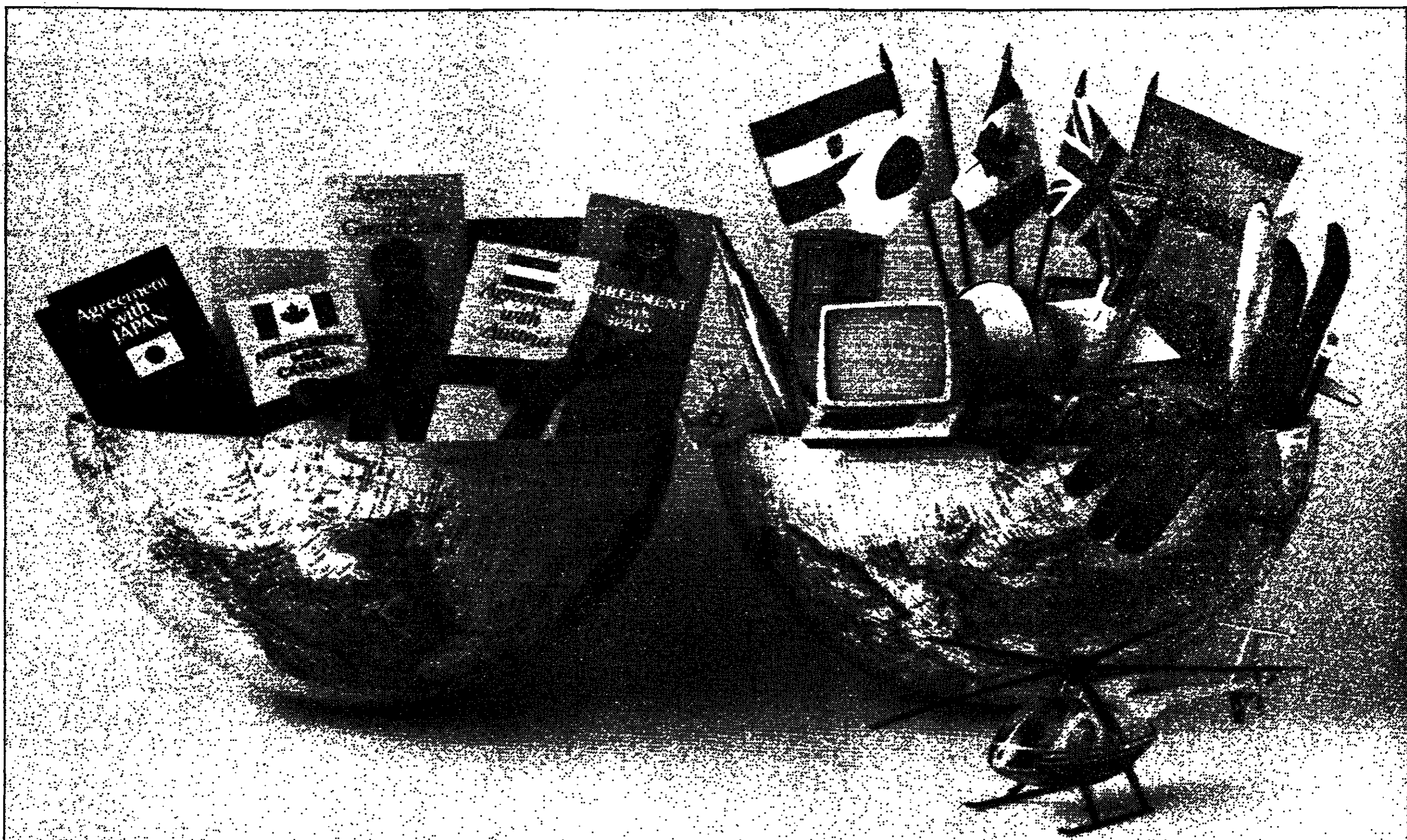
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Michael Dome

Lynton McLain



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# MCDONNELL DOUGLAS

Business aviation

# Marked decline in US sales

BUSINESS AND general aviation has faced two major developments in the past year.

In the UK, the most controversial issue has been the civil Aviation Authority report, CAP 522, on runway and airport capacity in the London and south east area.

In the US, home of the world business and general aviation industry and source of the majority of aircraft owned or used by companies for business, sales of new aircraft have stagnated and in some cases fallen by their greatest amount since the second world war.

The Civil Aviation Authority, in its final advice to Mr John Moore, Secretary of state for Transport on the subject of air traffic distribution in the London area, recommended a total ban on business aviation movements at Heathrow and Gatwick airports during the hours that these airports would be at full capacity as indicated in the airline scheduling committees' plans.

The British Airports Authority, the Business Aircraft Users' Association and the scheduling committees did not agree with such a ban and said so in their submissions to the Secretary of State for Transport.

In the event, Mr Michael Spicer, the Minister for Aviation, who announced the

Government's decision in response to the CAP 522 report, said that the Government would give priority to passenger airlines at peak hours by banning general, business and all-cargo flights at Heathrow and at Gatwick at those times. The Government reserved the right to make exemptions.

The Government considered that there should be no additional rules on restraining aircraft use by any categories of aircraft until it became absolutely necessary — that is, when existing runway capacity was saturated.

It wanted the existing system of allocating take-off and landing slots by the airports' and airlines' scheduling committees to continue, to meet the problems caused by steadily-rising demand.

In the meantime, the Department of Transport has identified the need for a further examination of the use of runway capacity at the London airports and has asked the CAA for a special study.

The Business Aircraft Users' Association, in a letter to its members shortly before the Government response was announced, said it would be a mistake to consider the issue a problem solely for users of Heathrow and Gatwick, "or that business aviation itself in fact

poses a serious problem at these two airports."

The association argued that it had been possible so far to accommodate the needs of business aviation at Heathrow and Gatwick, "despite planned full-capacity by scheduling committees."

Business aviation is the sector of general aviation concerned with the operation of aircraft by companies for the carriage of passengers or goods as an aid to the conduct of their business. Members of the association include leaders of industry and commerce and "the principal creators of wealth and employment," the association told the Secretary of State.

Mr Derek Leggett, chief executive of the Business Aircraft Users' Association, criticised the CAA for "unnecessarily, too quickly and too arbitrarily" taking the soft option by recommending that business aviation should be banned from Heathrow and Gatwick during hours to be decided by the scheduling committee.

The association was prepared to accept, "when demand temporarily outstrips capacity," a system of allocation of use based on historic patterns and ratios. These would spread the allocation of the temporary

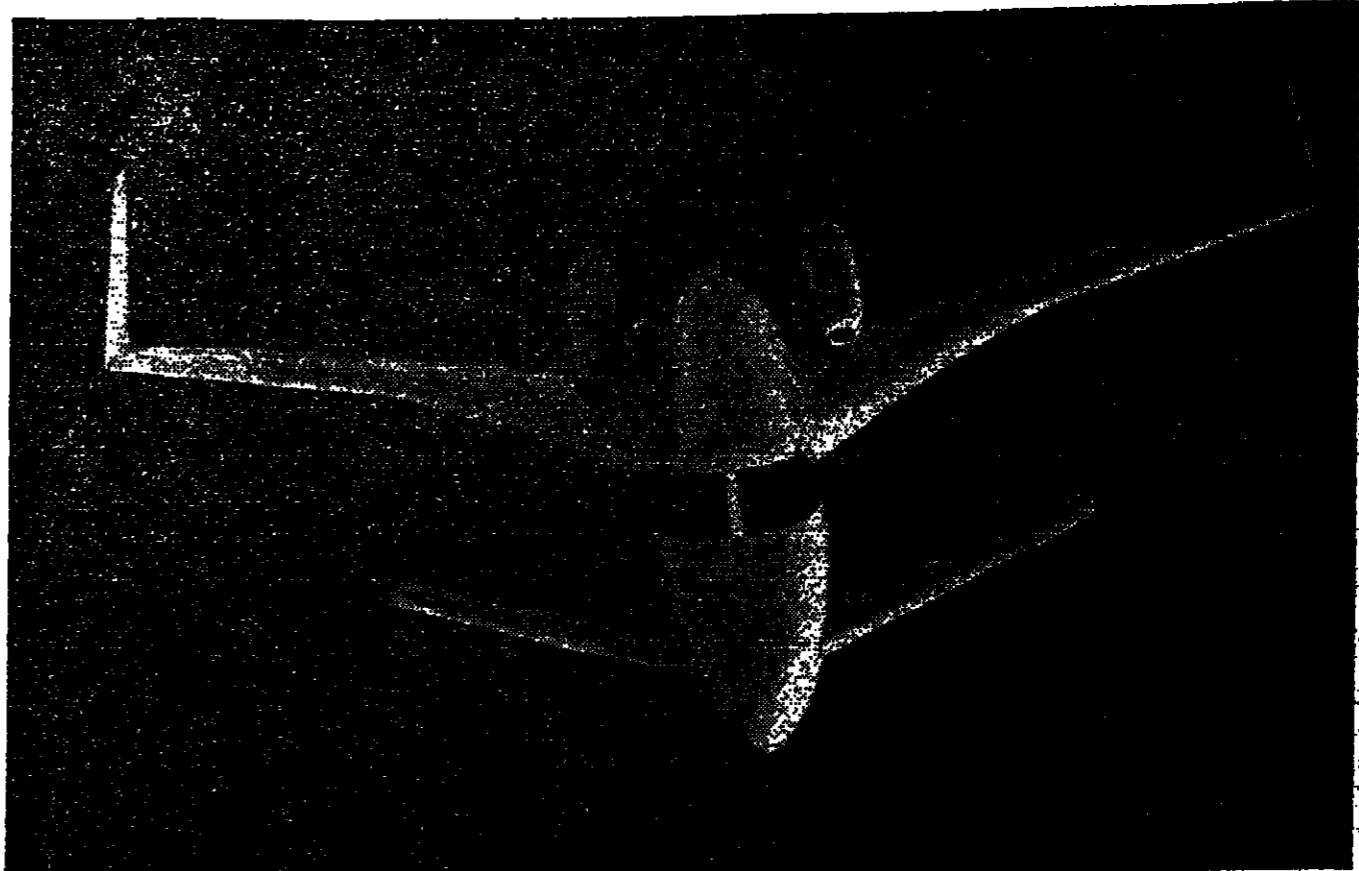
shortage proportionately among the classes of operators. The association was firmly against any limitations imposed artificially on the basis of class or category of operation.

Business aviation users point out that they need to retain fair access to Heathrow and Gatwick airports. Connection with world airlines is often necessary and some business aircraft have radio aids that can only be used at Heathrow.

The industry has not ruled out the development of suitable relief airports for business traffic in the London area and would encourage these airports to be used by business aircraft, but it wants relief airports to be considered with much greater urgency.

These airports would have to be properly equipped and provide the same margin of safety for operation in all-weather conditions as the major metropolitan airports.

In the general aviation sector in the UK, traffic has been falling in recent years, with an 11 per cent decrease in the total number of general aviation aircraft movements in South East England since 1980, according to figures from the CAA. There was a total of 1.4m movements in 1980 compared with 1.2m movements last year.



The Beech Starship I is a revolutionary design concept for business and executive aircraft now under development. First deliveries are scheduled for mid-1987

In the US, the biggest single market for business and general aviation aircraft, sales of new aircraft excluding helicopters have fallen sharply this year, with few signs of a recovery.

In the first half of the year, the US general aviation industry reported the delivery of 649 aircraft worth \$409.1m. The results represented a decline of one-third in the number of aircraft sold compared with nearly 1,000 sold in the first half of last year.

The sales value of the aircraft in the first half this year was almost 40 per cent down compared with the corresponding period in 1985, according to the US General Aviation Manufacturers' Association.

Single-engine aircraft deliveries, at 483 aircraft delivered, were down 25.7 per cent on the first half last year. A total of 43 twin-engine piston aircraft were delivered, a decline of almost 60 per cent on the period last year.

Business jet and turboprop aircraft accounted for 37 and 86 deliveries respectively, down 43.9 per cent and 43.4 per cent on the period last year. Three makers delivered fewer than five aircraft in the first quarter 1986: Gates Learjet delivered two Lear 35A business jets; Gulfstream Aerospace delivered two Gulfstream three large business jets and a Commander 1000 turboprop; Fairchild Aircraft delivered four Metro 3 commuters.

Despite the current poor

sales outlook, some manufacturers continue to develop new types.

Gulfstream has begun production of its new Gulfstream 4, expected to receive FAA certification in September. The company has \$1.5bn backlog of orders for the aircraft.

Beech of the US has produced its revolutionary Starship business turboprop made with a completely composite structure. The aircraft has two rear-mounted pusher propellers and highly-swept wings with a foreplane ahead of the main wing.

The aircraft uses 25 per cent less fuel than a comparable business jet, according to Beech, and is designed to carry eight to 10 passengers over a distance of 2,250 nautical miles.

The US business and general aviation industry has been faced with a proliferation of product liability lawsuits. These have been given by the main manufacturers of general and business aviation aircraft as the single biggest hurdle to be overcome if sales of light aircraft are ever to be restored to anything like their usual levels. Few observers believe that this return to high sales is likely in the foreseeable future.

A typical comment on the impact of the product liability

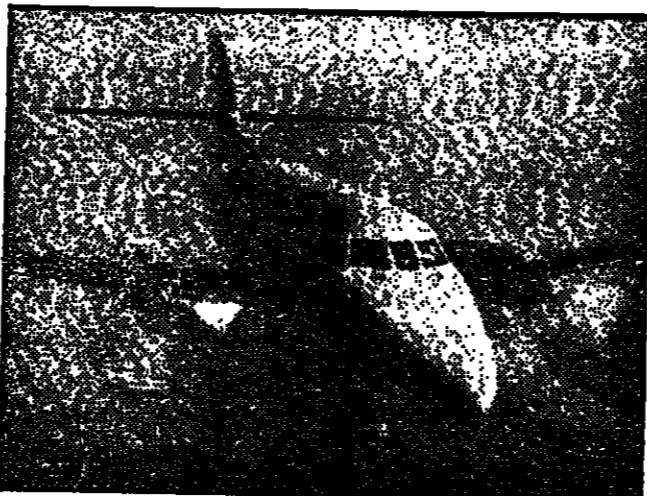
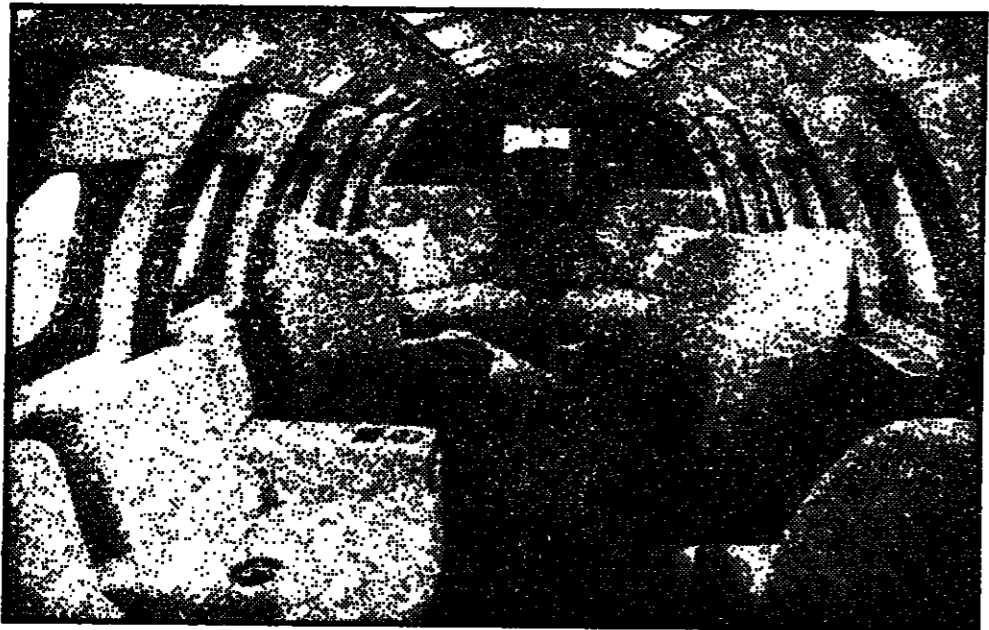
lawsuits on sales of general aviation aircraft and their equipment came from Mr Frederick Sonntag, president of Unison Industries, in evidence to the US House sub-committee on transport, aviation and materials.

The company makes magnetos and ignition wiring for general aviation aircraft, but recently scrapped a year's engineering research on a new electronic ignition product.

"The reason we did so," he said, "was not economic or technical. We were mostly concerned with the potential product liability risk of such an innovative product. We were afraid of becoming a technological pioneer and potentially subjecting ourselves to some plaintiff's attorney second guessing our decision in a lawsuit."

This type of concern has contributed to the decline in sales of light, general aviation and business aircraft in the US and has helped to depress total sales of commuter and business aircraft from \$2.1bn in 1984 to \$1.9bn in 1985. Domestic US sales suffered a decrease of 77 per cent in volume and 83 per cent in dollar value over the period.

Lynton McLain



Left: Interior of a British Aerospace 125 Series 800 twin-engine executive jet, the latest version of this highly-successful aircraft, capable of non-stop flights of 3,000 miles. Above: the Jetstream 31, the company's commuter airliner which has also made its mark.

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Aerospace 9

New Techniques

Revolution in technology

AS THE costs and complexity of modern military and commercial aircraft, guided weapons and space hardware continue to increase, the aerospace industry, for many years a pioneer of new techniques of manufacture and of new materials, is stepping up its own efforts to generate and exploit further technological advances. And it is encouraging its suppliers in many other industries to do the same.

In military aircraft, the requirement is for more efficient, lighter, faster, more agile, stronger and cheaper aircraft than in the past, and this requires more complex manufacturing techniques.

The prime requirement in commercial aircraft, apart from strength and safety, is for reductions in weight to save fuel and bring down operating costs for the airlines—savings which can be passed on in lower fares and rates to passengers and cargo shippers.

In guided weapons, meticulous precision in performance at very high speeds is essential; while in space hardware, whether satellites or manned spacecraft, durability of performance in an exceptionally alien environment is paramount. In all these requirements place upon materials, systems and structures are exceptionally severe, and throughout the world the aerospace industry is continually seeking improvements in all fields, to keep costs within acceptable limits for the ultimate customers, whether governments, air forces or airlines.

Other requirements are also becoming more stringent. Manufacturing times must be reduced, not only to help keep costs down but also to ensure that an individual company's or country's products are not overtaken by competitors.

At the same time, the changing environment in which many aircraft and spacecraft are being required to operate—such as at greater altitudes and at greater speeds—is also leading to refinements in aerodynamic design.

The demand for a "common" wing for the next two European Airbus models, for example, the A-330 and A-340, one a twin-engine and the other a four-engine aircraft, is already stretching the aerodynamic design talents of British Aerospace, despite the fact that it is already one of the greatest airliner wing specialists in the world.

In other areas also, major advances are being sought and achieved. The need for greater agility in combat aircraft has already led to the development of new systems of in-flight control, such as "fly-by-wire", where electronic signals control the manoeuvrability of the aircraft, and this is leading on to the use of fibre-optics, or "fly-by-light".

British Aerospace has done much work in these fields, especially with the "fly-by-wire" Jaguar demonstrator, with the result that the current Experimental Aircraft Programme (EAP) uses this system and it will be incorporated into the forthcoming Eurofighter itself.

The use of computer-aided design and manufacturing (CAD/CAM), largely pioneered in the aerospace industry but now widely used throughout general manufacturing industry, is still one of the basic tools of aircraft design, development and manufacture. But in many companies on both sides of the Atlantic it has been, and is being, carried to new heights of refinement.

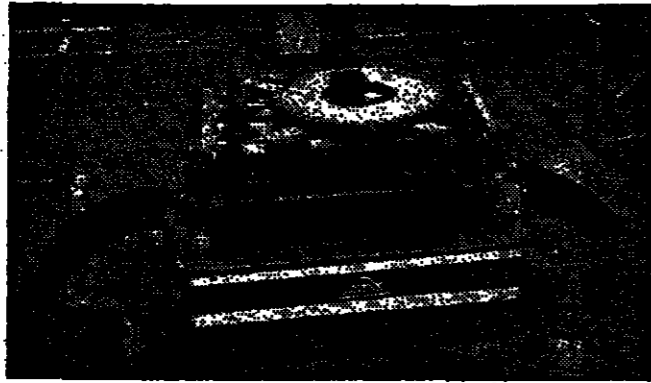
For example, at British Aerospace, it is being applied to the design and manufacture of jigs and fixtures required in the manufacture of detailed airframe components. At the same time, more extensive use of robotics is being made.

British Aerospace's military aircraft division at Warton, Lancashire, has also pioneered the development of what is called the "flexible manufacturing system" involving the complete automation of small parts manufacture from the receipt of the raw materials through to the finished component ready for assembly on an aircraft, with the minimum amount of operator intervention.

Using numerically-controlled machines under computer control, this system is generating savings of up to 80 per cent in manufacturing time, while reducing unit costs by 70 per cent, work in progress by 90 per cent and the cost of stock by 85 per cent. BAE's Warton factory is now one of the largest numerically-controlled manufacturing plants in Europe.

At British Aerospace, extensive use of new materials has also been progressively exploited to reduce manufacturing times and costs, especially in advanced military aircraft where more complex shapes are required than on aircraft of the past. In fact, activities have been particularly applied to the £180m Experimental Aircraft Programme (EAP), which is a technology demonstrator for the forthcoming Eurofighter, and will also be applied to the latter aircraft.

Extensive use is made of carbon fibre composites, which offer a reduction of 30 per cent in manufacturing cost because material on the latest engines, giving considerable weight of the reduction in the number



Automatically-guided vehicle carries a turbine disc in one of Rolls-Royce's Derby factories. Rolls-Royce has introduced an extensive integrated manufacturing system (AIMS) to automate and cut the costs of manufacture

of detailed parts, along with increased strength-to-weight ratios, a reduction in waste materials and easier production of large, complex, curved shapes.

Work is also being carried out in BAE on super-plastic forming and diffusion-bonding techniques which appear to be well suited to the use of titanium, enabling this strong, lightweight metal to be formed into complex shapes. Such techniques are used in production of wing components for the A-330 Airbus, offering dramatic weight-saving benefits, and will also be used on new generations of advanced military aircraft.

Super-plasticity is a phenomenon which occurs in a number of metals which have a suitable micro-structure (certain alloys of aluminium, titanium and steel) whereby at temperatures of about 50 per cent of melting point, the metal assumes a so-called "super-plastic condition".

In this state, and under load, the metal will deform at near constant stress to give the complex shapes required in aircraft manufacture.

In addition to weight savings and a higher level of damage tolerance, such parts can be reduced in number, while also allowing for reduced assembly and fabrication time, thus resulting in lower manufacturing costs.

Diffusion-bonding, in simple terms, is where a number of suitable pieces of metal are pressed together at a critical temperature, the change in the grain structure causing atomic diffusion across the joint line. The resulting structure becomes a single piece of metal—the joint line disappears.

At present, for aircraft design purposes, this process is applied to titanium alloys, with resulting structures that are competitive in terms of both cost and weight, with carbon fibre composites and conventional aluminium alloy designs.

At Rolls-Royce, considerable attention is paid to what the company calls the "management of technology". This involves keeping under review all the economic and competitive factors which affect the future of its business.

Advanced technology and demonstrator programmes are undertaken so that Rolls-Royce can keep its options open and make the most of business opportunities offered by new engines and developments of current ones when they arise.

Research and technology demonstrator programmes prove the effectiveness and practicability of technical advances at relatively low cost before they are applied to an engine which will go into development, production and service.

This ensures that technology for new engines is proven in advance. This "up-front" expenditure on technology has reduced overall engineering costs by up to 60 per cent.

Specific recent developments in new technology by Rolls-Royce include advances in engine turbine blade manufacture, whereby the crystal line grain structure of blades is controlled while they are being cast. This has led to directionally solidified (DS) and single-crystal (SC) turbine blades.

DS blades are cooled in such a way that the molten metal solidifies as crystals stretching the length of the blade—giving greater strength in this direction to carry its high centrifugal loads. These blades are more reliable and have a longer service life than those with a crystal structure providing the same strength in all directions.

SC blades are cast in a more uniform manner for the whole blade to solidify as a single crystal of high-strength metal.

Rolls-Royce has advanced computer-controlled facilities for the manufacture of DS and SC blades which are unique to the company. It is also a leader in non-destructive testing and techniques for checking whether the crystal axes within SC blades are correctly aligned to provide the required strength characteristics.

Other advances being studied include new techniques for the manufacture of engine components including those based on powder metallurgy. Ceramics, too, have long offered the promise of being an effective high-temperature material for turbines if adverse factors such as their brittleness

savings over the steel retention rings used on earlier high-bypass turbo-fan engines.

Rolls-Royce has pioneered in many other advances in aero-engine development, including the application of computers to a wide range of research, design and manufacture, together with the construction of major new advanced test facilities such as new test facility at Hucknall, an advanced compressor test facility at Derby and a turbine test facility at Bristol.

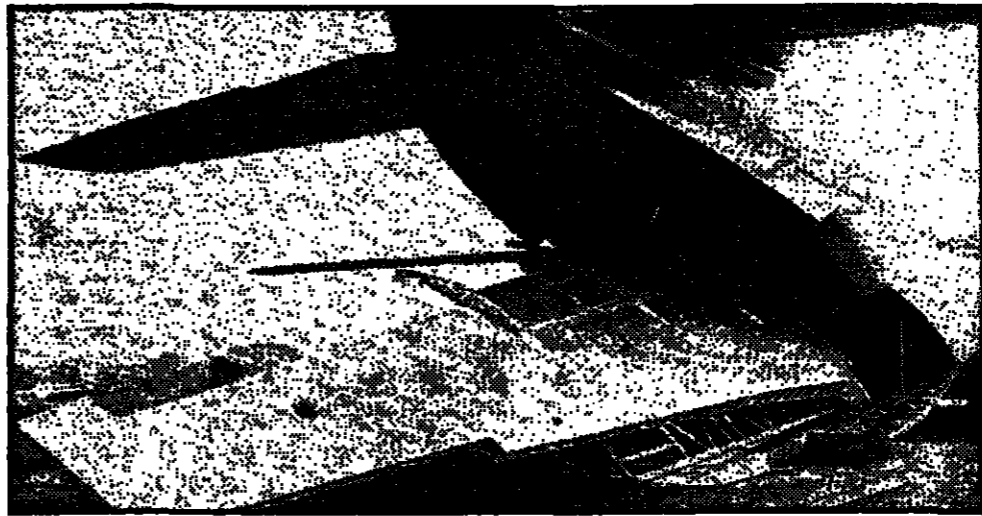
The company has built a new gearbox test rig for work on the forthcoming generation of prop-fan engines.

The introduction of advanced machining centres and robot handling has made it possible to produce engine parts faster, more efficiently and more economically and to reduce the large inventories of work in progress that were typical of engine manufacture in the past.

There are many other new techniques of manufacture, and new materials, now moving into aerospace. The advanced technological revolution has effectively only just begun, and over the next few years it can be expected to accelerate, as the requirements of civil and military aviation themselves become more stringent and complex.

Kevlar, the carbon fibre composite made by Du Pont, is used as a fan-blade retaining

Michael Donne



Wings built by Short Brothers of Belfast for the Dutch Fokker 100 jet airliner are loaded into a giant freighter of Heavy Lift Cargo Airlines for shipment to Amsterdam

Air cargo

Fall in tonnage carried

ALTHOUGH WORLD air freight activity showed a significant improvement during the 1982-1984 period following the airline recession of the early 1980s, culminating in a 9 per cent growth in the tonnage carried in 1984, last year there was a small decline, to 13.2m freight tonnes carried.

This fall is attributed to the rate of

recovery from the recession in some of the Western world's major economies during 1985, which has apparently also continued into the early months of 1986, especially on the North Atlantic route.

Figures issued by the British Airports Authority (now BAA plc) for the first six months of 1986, for example, indicate

that the tonnage of cargo handled by its seven airports (including Heathrow and Gatwick) remained virtually static at 740,550 metric tonnes.

This situation is widely regarded in the air transport industry as temporary. At the current level of more than 13m freight-tonnes, air cargo is still at its highest ever, reflecting

the increasing interest being shown in freight as a potential contributor to revenues and profits among most of the major airlines in the Western world.

In many airlines, vigorous efforts are being maintained to overcome current problems and ensure a resumption of growth in the years ahead. There is fierce competition not only between airlines and freight forwarders but also between individual airports, to win the business that is available and promote further expansion.

In the UK, these efforts are being spearheaded by BAA plc through its London Air Cargo Promotion Group (called the Task Force) which brings together all elements of the air cargo industry to promote the concept of the UK, and the London area in particular, as a major air cargo centre.

The Task Force's "Gateway London" message has been carried to many parts of the world, and last May the sales promotion drive was taken to the Far East, via Tokyo and Osaka.

The efforts of the Task Force in 1985-86 resulted in London taking second place (after Frankfurt) in the European air cargo league—the first significant change since 1981-82.

BAA plc points out that the opportunities for London to capture lost traffic and to gain new business remain "very good" but it adds that industry-wide consultation and co-operation "must be supported and strengthened if London is to regain its position as the premier European cargo gateway to the world."

MD

FARNBOROUGH INTERNATIONAL AIR SHOW 1986

BUSINESS AT THE TOP, MEET THE LEADER. THE FALCON 900.

September 1986, the world of business aviation meets its leader, the Falcon 900, at the Farnborough air show.

Recognized as the leader by aviation experts who flew it, the Falcon 900 is not a project any more: it flies... and production follows on.

A leader in comfort, the Falcon 900 sets new standards in the balance of cabin proportions, volume, light and silence. The degree of engineering knowhow applied to the most trivial elements of comfort is astonishing.

A leader in performance, the Falcon 900 is not only allowing ample intercontinental range, it also has the lowest approach speed and the highest speed limit. It may cruise at 0.85 times the speed of sound but proved it can fly at .94 Mach.

A leader in optimization, the word to express an unceasing quest for efficiency, the Falcon 900 is optimized not maximized. Thus, taking off for its maximum trip, the Falcon 900 will weigh 21,000 kilograms, 10 tons less than its competitor, yes... one third less weight. Efficiency is also in the modern systems in ever more reliable and thrifty Garrett engines. It is also in a degree of maintainability never reached before.

A leader in safety. With the reliability of three engines and their associated systems, with the famous Falcon control system and flying qualities that pilots appreciate in every flying condition, the Falcon 900 embodies the solid strength of good engineering.

Aerodynamics, flying features, quality of engineering issued from wide and far reaching experience, design for availability, every feature qualifies the new leader in the world of business aviation. The Farnborough air show this year offers you a chance of meeting the Falcon 900. A business meeting to be given high priority in your schedule...

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Business takes off with Falcon

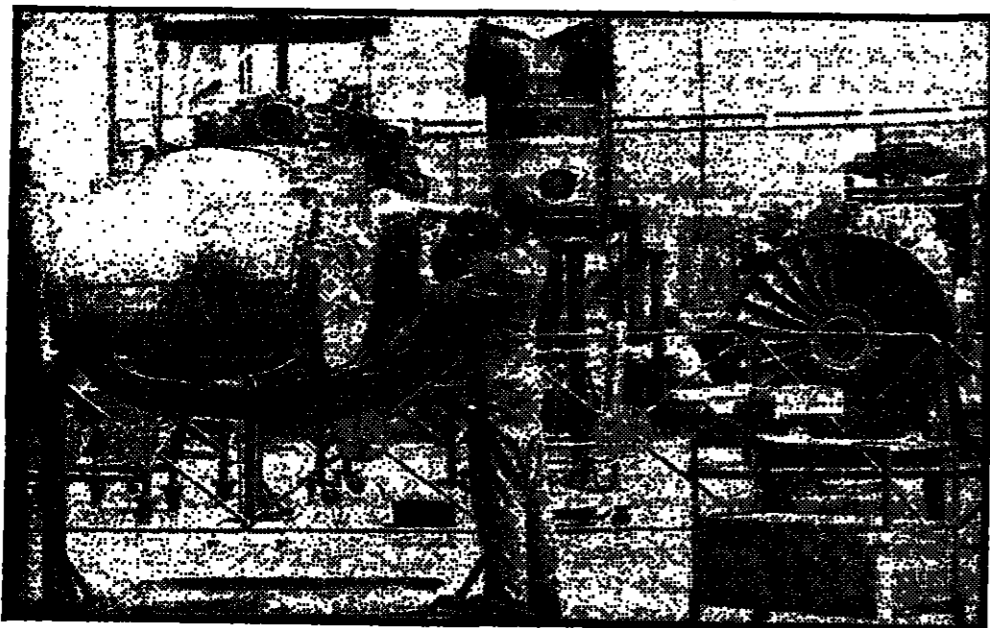
Aerospace 10

Engines

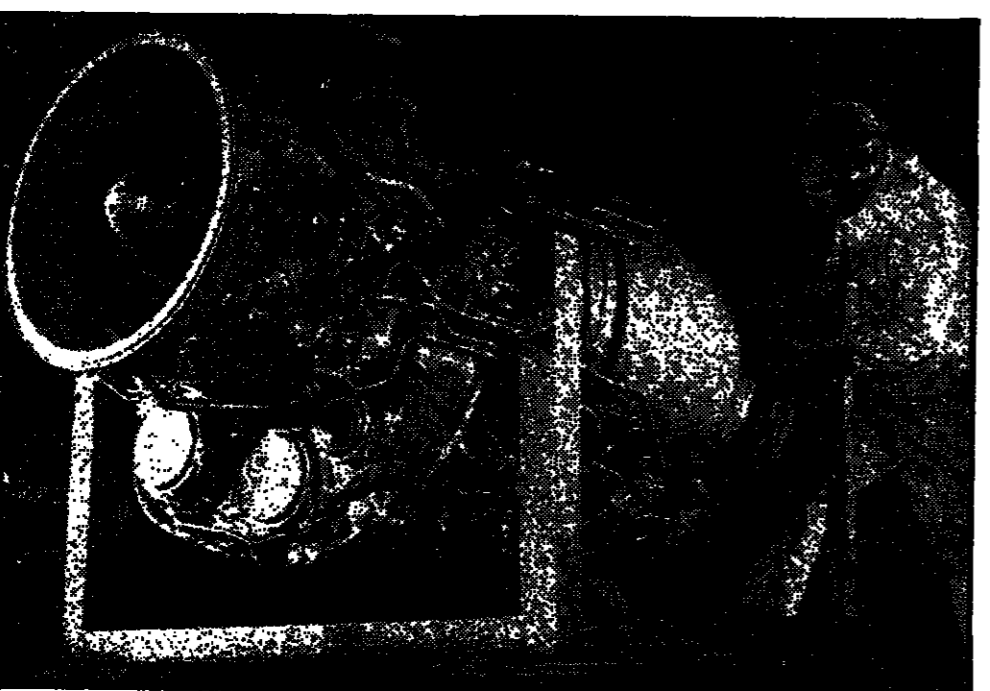
Waiting for the prop-fan era



Pratt & Whitney's latest "high-thrust" turbo-fan jet engine is the PW4000, for Boeing 747 Jumbo jets, tri-jets and wide-bodied Airbus aircraft



The Rolls-Royce Pegasus 406 is the latest production version of the vectored-thrust jet engine used in the advanced British Aerospace-McDonnell Douglas AV-8B Harrier II fighter for the US Marine Corps



The Adour jet engine is a joint venture by Rolls-Royce and Turbomeca of France, for the Jaguar jet fighter and the Hawk fighter and trainer aircraft

ALTHOUGH THE world's major aero-engine manufacturers continue to spend considerable sums on the development of turbo-fan (jet) and turbo-propeller engines of all kinds, in the certainty that these types of power-plant will remain in airline service well into the next century, an increasing volume of investment is now being devoted to a new development—the prop-fan engine.

Various claims have been made for this type of propulsion that it can offer reductions of up to 40 per cent in fuel consumption compared with current generation turbo-fan engines, or 25 per cent better than the new generation turbo-fans now under development, together with less noise and pollution, while also yielding aircraft speeds equivalent to those provided by jet engines themselves.

Such claims have to be proved, however, but if they can be justified, the prop-fan engine will clearly be a formidable competitor to conventional turbo-fan and turbo-propeller propulsion. Already extensive prop-fan research is being undertaken by all the major engine manufacturers, and interest in the concept is widening.

Fundamentally, the prop-fan is a derivative of the already well understood concept of harnessing a propeller to a gas-turbine engine to provide turbo-propeller power. The differences lie in the design and number of propeller blades, usually up to 16, mounted in two sets of eight on two counter-rotating hubs, and designed rather like scimitars or ships' screws instead of the conventional propellers of today.

Also, the design of the gas turbine engines themselves has been improved to give substantially greater efficiency. The combination of these developments generates the savings and other benefits claimed for the prop-fan engine.

Work on prop-fans has been under way for several years, especially in the US where a joint Government-sponsored programme starting late this National Aeronautics and Space Administration and the aero-engine manufacturers has resulted in plans for flight-test programme starting late this summer and next year on various prop-fan engines, using blades built by Hamilton Standard of United Technologies.

General Electric is probably further down the development road with its GE-36 engine, which is to be tested on a Boeing 727 flying test-bed starting late this summer. This will be designed to provide sufficient confirmation of earlier predictions to enable GE to put the engine into production around the end of this year, and Boeing to press ahead with its plans to launch a 150-seater prop-fan powered airliner, the MD-94X, in the first half of 1987 for entry into service in 1992.

At the same time, much work has been done by the Allison Division of General Motors, in conjunction with Pratt & Whitney, on another, smaller,

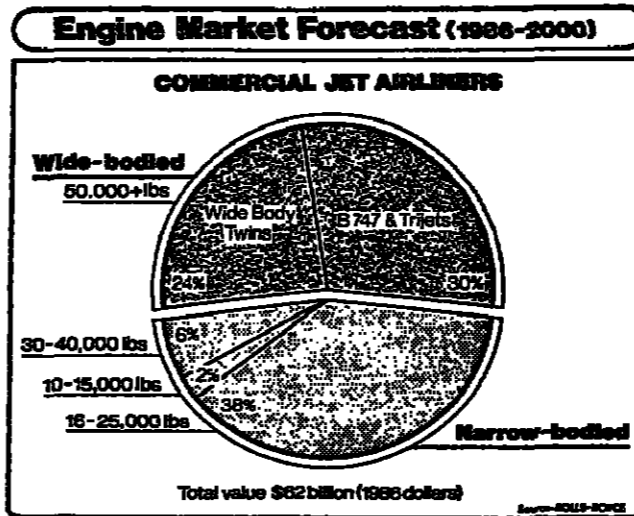
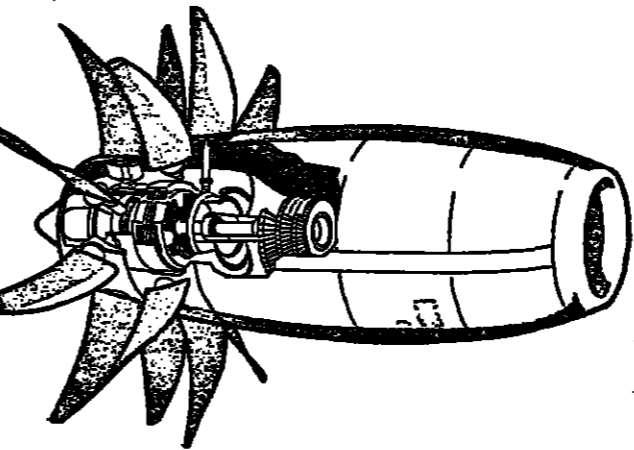


Table titled 'The Competition in Aero-engines' comparing Pratt and Whitney, General Electric, and Rolls-Royce engines across different thrust categories.



A prop-fan engine. The gas-turbine "core" (right) generates the power to turn the counter-rotating hubs (left) on which are mounted several propeller blades, shaped rather like ships' screws. These blades can be "open," as shown, or "ducted," surrounded by a nacelle

prop-fan engine, the 578DX, which will be flight-tested in a McDonnell Douglas airliner next year. If successful, that flight test will be followed by further tests of the GE engine in the MD-80 aircraft.

The object of both tests will be to help McDonnell Douglas to refine its own ideas on a prop-fan airliner design, the MD-91X, which it plans to offer the airlines next year for service in 1991.

A bigger, 160-180 seat airliner, the MD-94X, could be built for delivery in 1994, to rival the Boeing 737. Mr James Worsham, president of Douglas Aircraft Division of McDonnell Douglas, has said: "We can make it happen, or we can watch it happen; but it will happen—before anyone else."

Both the Boeing and Douglas ventures involve extensive international collaboration. Boeing has gained a 25 per cent financial and engineering development stake in the 737 from the Japanese aerospace industry, and also has partnership agreements with Saab Brothers of the UK and Saab of Sweden.

McDonnell Douglas has partnership agreements with Aeritalia of Italy, the Shanghai Industrial Aviation Corporation of China and Saab of Sweden. Both Boeing and Douglas are looking for additional partners. Both are also consulting many major world airlines to deter-

mine the most popular interior layouts for their prospective airliners. But there is still much to do. Noise levels, vibration, and safety issues such as blade security, have all to be satisfactorily settled before the aircraft can be accepted for service, in addition to confirming the fuel consumption claims. Also, there are differing views on the merits of different designs—such as the Allison/Pratt engine against gearless engines (as in the GE prop-fan).

But GE itself appears to have no doubts. It says that its engine, which it calls an "Unducted Fan" or UDF (others call their prop-fans "Ultra High-Bypass" or UHB engines and there are already many variations on the trade names involved), is already a reality.

When GE announced its intention of building a counter-rotating UDF engine with world-beating fuel efficiency, the industry had doubts, says the company. It has been done. The proof-of-concept engine began ground testing in August, 1985. It set and holds the world's record Specific Fuel Consumption for turbo-fan engines, of 0.24 lb of fuel per hour per pound of thrust. The UDF proof-of-concept engine has already achieved 25,000 lb of thrust.

"Vibration forces are an order of magnitude lower than in a conventional turbo-fan. And scale-model testing has already demonstrated blade configurations that meet Federal Aviation Regulations FAR 36 Stage III noise requirements, with additional improvements already in view."

Rolls-Royce is also working extensively on the prop-fan concept, in a variety of ways. It says that the possibilities in this field include not only "open rotors," where the propellers are at the rear of the fuselage and are not covered by a nacelle, suitable for the

smaller 150-seater airliners, but also "ducted rotors," which are larger engines with shrouds or nacelles round the propellers. This makes them suitable for under-wing installation on bigger aircraft such as the Boeing 747 Jumbo jet.

Rolls-Royce is committing considerable technical resources to this work, which is aimed at the possible start of full-scale production in the 1990s. The research has included the construction of a new test facility for gearboxes transmitting up to 15,000 hp—such gearboxes being likely in its view for future prop-fan engines.

While recognising that there will be substantial interest in the prop-fan engine in the smaller aircraft, such as the 150-seater 737 and 100-seater MD-91X in the early 1990s, Rolls-Royce believes that the biggest market, in terms of value, will emerge in the larger aircraft of over 200 seats for medium to long ranges, such as new-generation tri-jets or Jumbo jets, in the mid to late 1990s.

Much of Rolls-Royce's prop-fan work is thus currently being directed towards engines for the bigger aircraft, with studies on what the company calls a "contra-fan" engine which might be suitable for new versions of the Boeing 747, such as the Series 500 for very long ranges in the mid to late 1990s. Already its studies have indicated that it would be possible to develop an engine of reduced length and weight compared with original design ideas.

Interest in the prop-fan is now growing rapidly and the concept is in fact now developing a momentum of its own. In West Germany, Messerschmitt-Bölkow-Blohm has signed an agreement with Catic, the import-export agency of the Chinese Ministry of Aviation, to co-operate on development of a 75-passenger commuter-size prop-fan transport, the MPC-75. A feasibility study is to be completed by mid-1987, and the partners will then decide whether the market would support full-scale development.

MBB's current view is that it will have an estimated sale of at least 900 aircraft of the 70-80 passenger size by the year 2004, with up to 250 in China itself. MBB has also signed an agreement with General Electric of the US, which is already working on the prop-fan for the bigger Boeing 737 150-seater, for development of a smaller engine for the MPC-75. The next step will be for the company to design a full-scale contra-rotating gearbox that could be tested in 1988-89, and a prototype engine could run by 1990 with service entry in the mid-1990s.

However, the company is also working with airframe manufacturers such as Boeing on the production of a gearless contra-fan for under-wing mounting on wide-bodied aircraft, such as Jumbo jets, an arena which it believes potentially represents over 50 per cent of power-plant demand to the year 2000.

Space

Western confidence takes a knock

THE STEADY progress towards increased commercialisation of space ventures in the West has come to an abrupt halt with the series of rocket accidents which has crippled its satellite launching industry. It has cast a pall, at least temporarily, over ambitious plans in the US and Western Europe for a manned space station in the 1990s.

Meanwhile, the focus of international attention in space activities has shifted eastwards. The Soviet Union has already launched about 40 satellites this year, has sent into the heavens a new improved space station, and in what amounts to a series of space-age taxi rides, has ferried cosmonauts between this and an earlier station already in orbit.

In July, two Soviet space men, Vladimir Soloyov and Leonid Kizim, completed a four-month stint shuttling between the two stations.

The spotlight has turned, too, on the space activities of China and Japan. China is offering launch services to the West with its Long March 3 rocket—these vehicles or previous generations have lifted into space about 20 satellites, all of them Chinese—while Japan is quietly developing the foundations for an impressive space programme of its own, including even a Japanese version of the space shuttle.

Over the next two years, governments and companies had planned the launch of about 30 commercial communications satellites in either Ariane or the Space Shuttle.

Germany for such ventures have been put back owing to the problems with Ariane.

In Britain, meanwhile, the Independent Broadcasting Authority is asking companies to submit their bids to run a UK TV satellite later in the decade, with a government decision on the issue due next year. But companies are likely to think twice about putting in a submission when they realise that launching the satellite will be extremely unlikely in this period because of the queue building up for Ariane and the Space Shuttle.

Besides holding up satellite schemes for TV broadcasting and telecommunications, the launch hiatus may also affect replacement of the ageing satellites currently in orbit for jobs such as monitoring the weather or taking high-resolution pictures of the Earth's surface.

According to space analysts, the Chinese, Japanese and Soviet rockets to which the West could turn for launches are unlikely to provide a solution. These are unlikely to take into orbit more than a handful of Western satellites over the next decade—the Chinese and Japanese rockets are relatively unproven while sending sophisticated satellites to the Soviet Union for lift-off poses security problems for many Western governments.

Ambitious plans to bring into the space business companies from outside the aerospace industry have also been affected. There had been suggestions that by the end of the century manufacturing companies—for instance in chemicals or metals production—could be using space platforms to create new types of

materials in the exotic conditions of weightlessness or vacuum. Such forecasts look more than a little optimistic today.

A question mark also hangs over the US effort to lead a consortium of Western nations in building in the 1990s an international space station. Besides Western Europe, Canada and Japan are due to be the other partners in the venture, which is meant to provide orbiting workshops for experiments in areas such as materials science together with a space outpost for trips further into the solar system, and for satellite repairs.

The shuttle explosion has grievously damaged confidence in this kind of venture. More to the point, some of the \$8bn which NASA had earmarked for the plan (the other countries had been due to contribute a further \$4bn or so) may now be required to fund a replacement vehicle for Challenger, the cost of which would be about \$2.5bn.

Nasa suffered a severe public relations blow with the Challenger accident and the US Congress is unlikely to be as generous in sanctioning the agency's schemes as in the past.

The US Government now has to decide whether to scale down the space station venture—which could mean the production of a relatively simple station instead of the large and sophisticated base that was planned. This could well entail dropping ideas to involve the other nations—or put back the launch perhaps until after the year 2000.

Were it not for two factors—strong lobbying by the US aerospace industry and the high public profile of the successful Soviet programme in space

stations—President Reagan might already have felt compelled to cancel the space station altogether.

The lobbying efforts are trying to ensure that the station scheme is kept going to provide work for aerospace companies. If plans for the station were discarded, the industry would have little option but to disband teams built up since the early 1960s to work on manned space programmes.

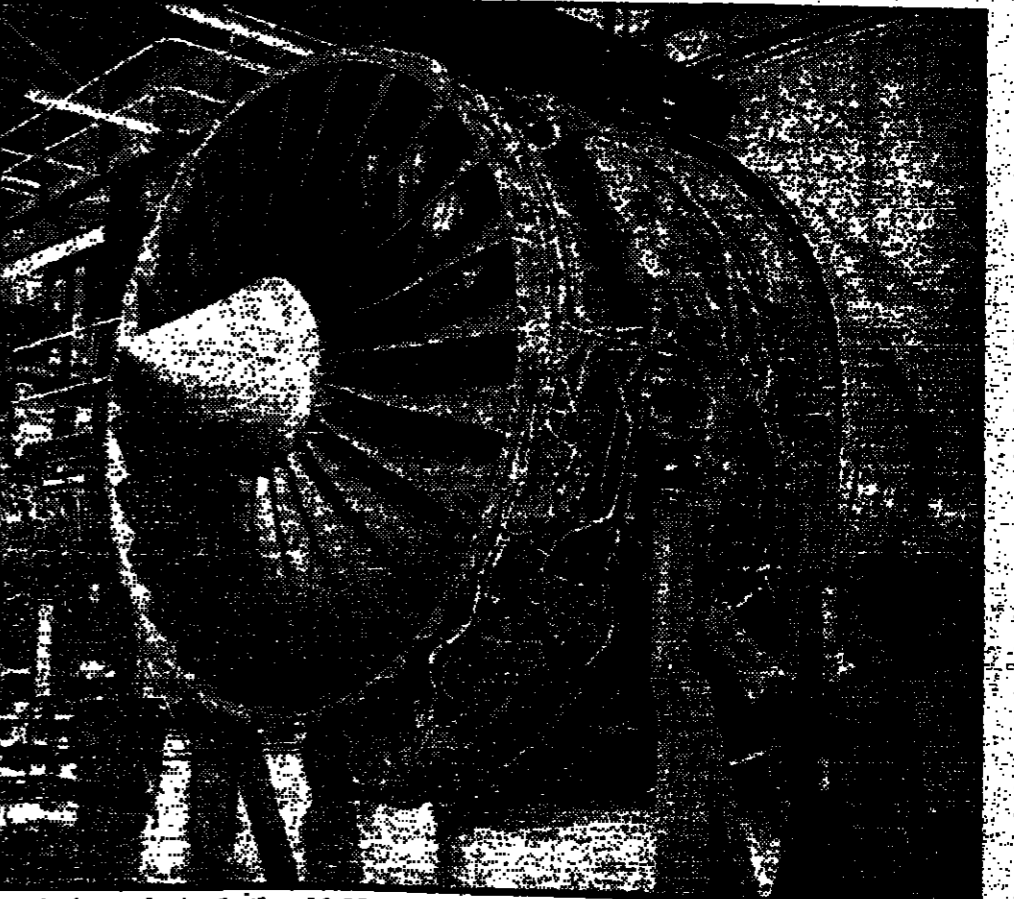
National prestige, meanwhile, will see to it that so long as the Soviet Union keeps up its space station plans, the US will be forced to do something similar. The USSR in this area is already worrying many in the US.

The Soviet Union has launched a total of seven manned Salyut stations, one of which is in orbit and was joined in February by the first of a new generation called Mir. Inside these capsules, people have lived and worked for up to eight months at a time, conducting a variety of scientific experiments and learning the rudiments of space habitation.

It appears likely that the Soviet Union has its eyes on a manned trip to Mars, perhaps some time soon after 2000. Such a venture would be a huge undertaking—and would cancel out America's success in 1969 in reaching to the Moon first.

The desire to match its superpower rival in extraterrestrial ventures will continue to be a powerful driving force in the US space programme—and will ensure that the country cannot simply pull out of or scale back space plans even when financial and industrial logic suggest that it should.

Peter Marsh

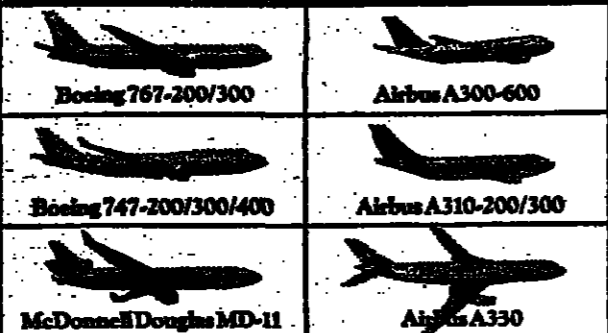


Latest version of the highly-successful Rolls-Royce RB-211 engine is the 524D4D of about 58,000 lbs take-off thrust, already ordered by Cathay Pacific Airways, and now also ordered by British Airways for the Boeing 747 Series 400 Jumbo jet

Michael Doune



# CF6-80C2: THE ANSWER TO TOUGH, NEW REALITIES.



One reason is because the 80C2 incorporates only the new technologies whose reliability has been convincingly demonstrated in the CF6-50C and 80A, and in other programs for the B-1B, F-14, F-16, F-18 and the efficient F-119 engine.

Another reason lies in the basic design of the CF6 engine. While competitive engines are only now moving towards the high temperatures, pressures, and speeds of the 80C2, the 80C2 will operate at the same levels where it has accumulated millions of hours of proven performance and expertise.

With a quantum reduction in life cycle costs, and ability to power all widebody aircraft now in production and through the year 2000, the CF6-80C2 will continue its growing reputation

as the engine of the century. **PROMISES COUNT.**

Aircraft Engines



USA

The UK

# Testing time for decisions

THE UK aerospace industry is heading for another record year for turnover, exports and a positive contribution to the UK's balance of overseas trade. At the same time, however, it is awaiting some major government decisions on new ventures—such as the Eurofighter; funding for new versions of the European Airbus; and future space development plans—as well as decisions on the privatisation of Rolls-Royce and Short Brothers.

All of these will have far-reaching implications for the industry's future workload, export performance and profitability through to the end of the century. Annual turnover of the UK industry in 1985 amounted to well over £7bn, compared with close to £2bn in 1975. Over the same decade, the industry's exports rose from £750m to £4.2bn.

Today, the industry exports nearly 60 per cent of its turnover, or about 8 per cent of the UK's total manufactured exports, and in 1985, the industry made a positive contribution to the balance of payments of over £1bn.

Overall, the UK aerospace industry employs over 200,000 personnel directly, including some 35,000 in the electronics industry, with another 250,000 employed indirectly on aerospace work in other industries—such as metallurgy, chemicals, ceramics, glass, and hydraulics. Few industries, in fact, do not have some relationship, however remote, with aerospace.

Over the past decade, according to figures prepared by the Society of British Aerospace Companies, the aerospace industry has exported over £22.5bn worth of its products, which in terms of 1985 pounds is worth £11bn. Over the same period, the industry's contribution to the positive trade balance is £5.3bn, or in 1985 currency in excess of £5.5bn.

With the Western world's aerospace market expected to grow through to the year 2000 estimated to be worth over \$1,400bn (over £920bn), the UK industry is looking forward to capturing a substantial slice of that trade across the entire spectrum of civil and military aircraft, guided weapons and space hardware.

While much of that future success depends on the wide

range of products already in production or under development, an equally significant part of the industry's future depends upon new products and programmes now in the preparatory stage.

At the same time, much depends upon the freedom of the industry to conduct its commercial affairs in the way that it sees fit, which is why the privatisation of Rolls-Royce and eventually also of Short Brothers are regarded by many in the industry as imperative for the future.

British Aerospace, after its full privatisation, some time ago, has forged ahead, and it is hoped that similarly both Rolls-Royce and Short Brothers will be able to do the same.

Recently, in a message to staff, Sir Francis Tombs, chairman of Rolls-Royce, said that he expected Rolls-Royce would

skilled and responsible workforce, and this, together with the other strengths, would make it possible for the company "to return to the private sector with confidence and to use the opportunities of that move to consolidate our progress."

The company's sales in 1985 are expected to rise to £1.8bn, some £200m higher than in 1985, with a further rise forecast for 1987.

No decision on a date for the privatisation of Short Brothers of Belfast has yet been taken, although the Government has stated positively that it is on its list for eventual return to the private sector.

The company has been under Government ownership since it was taken over in 1943 during the Second World War. Since then it has had a chequered financial history, but has expanded considerably indus-

try ALF-502Rs for Bae 146s, and for the International Aero Engines IAE V-2500 for the Airbus A-320.

In military aviation, there is the prospect of some slow-down in the tempo of existing activity, as a result of cuts in the overall defence budget (1.3 per cent annually over the next three years) that may force the Government to spread out some programmes over longer periods of time than originally planned and reduce others.

Already, the Secretary for Defence, Mr George Younger, has indicated that some Harrier, GR Mark 5 jump-jet fighters may be cut from orders already announced, and that its introduction into RAF service may be delayed.

Overall, the message coming from the Commons defence debate earlier this summer was that major new ventures will be strictly reviewed as to both timing and funding.

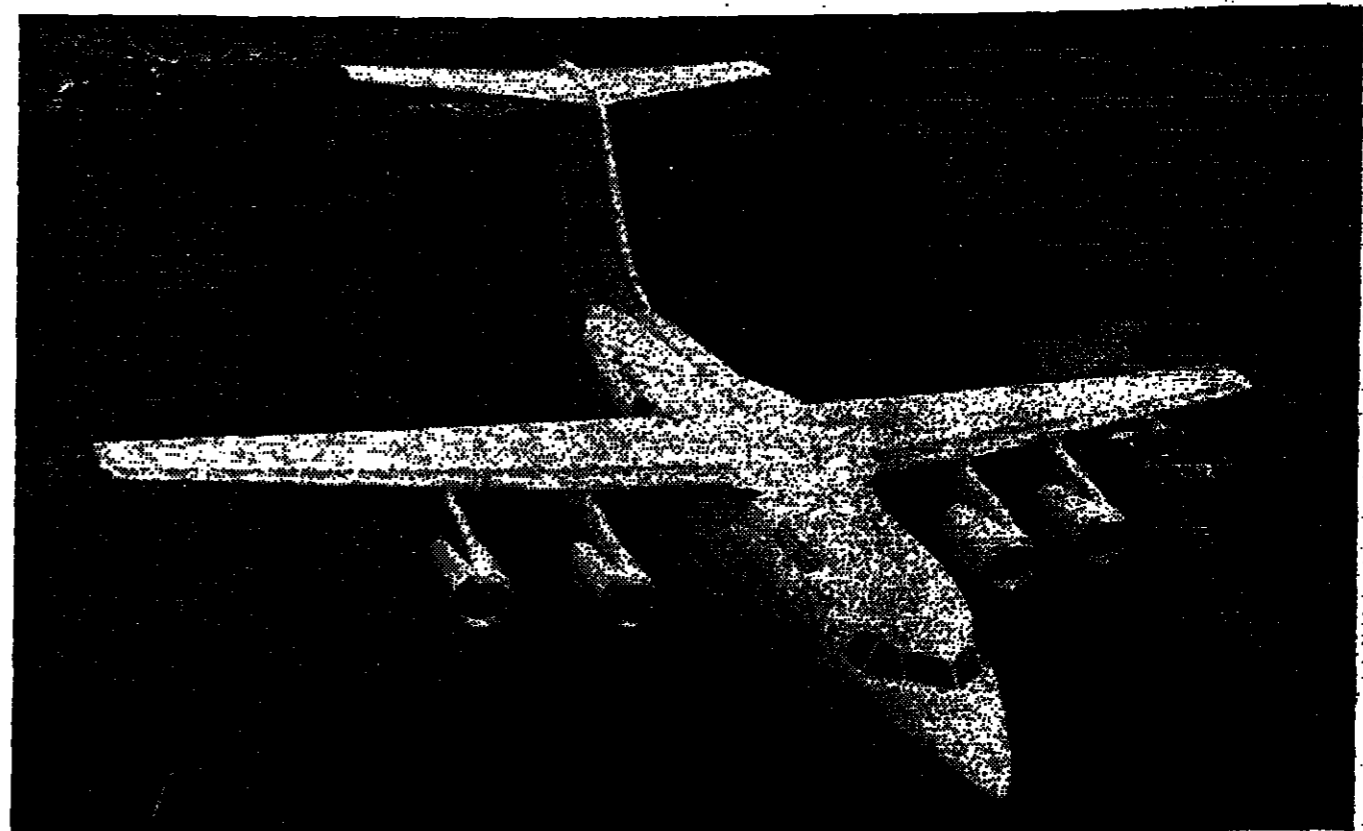
This situation may affect some current programmes, in addition to the GR Mark 5 Harriers, but there is no indication yet that it will affect the projected four-twin Eurofighter, now moving towards a critical go-ahead decision.

The Eurofighter is essential, not only to the RAF as a replacement for Jaguar strike aircraft and ageing Phantom and Lightning jets, but also to the UK military aircraft manufacturing sector which is now over the peak of production of Tornado multi-role combat aircraft.

Production of the latter has been extended as a result of additional orders recently from West Germany for an air reconnaissance version and from Saudi Arabia and Oman, but even so manufacture is due to end in the early 1990s, unless even further orders are won overseas (and strong efforts continue, especially for example in Indonesia and Turkey).

By that time, the production of the Eurofighter, of which the UK is expected to take about 200, will be getting into its stride, ensuring continuity of workload and employment.

Work on the project definition phase of the Eurofighter is now close to completion (target date is September), and the industry of the countries involved (UK, West Germany, Italy and



The British Aerospace private-venture four-engined Type 146 regional jet airliner, which is selling well, especially in the US

Spain) will then submit the project for approval by their governments, with a view to subsequent launching of full development as soon as possible.

As discussed elsewhere in this survey, the programme envisages over 600 aircraft for the four countries, with eight prototypes built to flight test the entire aircraft as a weapons system, and to enable production aircraft to enter service with the air forces involved in 1995.

The cost will be substantial, perhaps as much as £20bn, spread over the four nations, and the workload will keep the military side of the UK aerospace and associated industries (such as electronics) busy for many years, probably well into the next century.

In commercial aviation, the UK industry remains active in the manufacture of wings for the existing range of European Airbus and manufacture of complete aircraft such as the Bae 146 regional jet airliner, the Advanced Turbo-prop, the Jetstream 31 turbo-prop, the 125 series of executive jets and the Shorts 330 and 380 twin turbo-prop airliners.

British Aerospace, however, is also anxious to participate in the next generation of Airbus

now being planned—the medium-range, high-density, twin-engined A-330 and the four-engined, long-range A-340.

Airbus Industrie, in which BAE is a 20 per cent shareholder on behalf of the Government, is now planning to develop these for service in the early 1990s, with a formal launch expected around the turn of this year, depending on the inflow of launch orders.

Airbus plans to build the two aircraft with many common parts, including wings and fuselages, to keep down development costs but, even so, the overall cost has been set at not less than \$2.5bn and it may be considerably more.

This money must come from the partner companies, and so BAE itself expects to have to subscribe perhaps as much as \$500m for its share of the work—principally the wings for the two aircraft, the area in which it is now one of the world's experts.

BAE's problem is that its own cash resources are already heavily committed to other civil aircraft programmes so that much, if not all, of its contribution to the A-330/A-340 programme will have to be subscribed by the Government as launching aid.

At this stage, although informal discussions have been held with the Department of Trade and Industry, the view in Whitehall is that BAE cannot expect to receive the full sum required, and even then will have to make a first-class case for such support at it gets, in view of the Government's own desire to keep down public spending and a more critical approach towards launching aid for various aerospace ventures in view of past losses in that field.

It seems likely that BAE will have to seek some alternative sources of finance to top up whatever balance is needed to enable it to participate in the A-330/A-340 venture. The prospect otherwise is that BAE will have no part in that venture, and thus while continuing with its existing Airbus work, will be out of the further expansion of that organisation.

What does not seem to be in doubt is that even if BAE cannot gain a share in the A-330/A-340, those aircraft will be developed, one way or another, with other manufacturers already standing on the sidelines.

ready to pick up the lucrative wing business if BAE itself is not able to undertake it. Were that to happen, a major workload for the UK industry could be lost through the 1990s and beyond.

In space, Mr Roy Gibson, director general of the British National Space Centre, has now presented to the Department of Trade and Industry his National Space Plan. This involves a series of options, or "means" from which the UK Government can choose, with the highest cost being given to the development of the Hotel trans-atmospheric vehicle discussed elsewhere in this survey.

A wide range of options is involved, however, including whether or not the UK supports financially the development of the French-inspired Hermes manned spacecraft, how much the UK spends on development of its share of the Columbus (Europe's share of the US manned space station), and in the Ariane heavy rocket launcher.

The Government is likely to study the plan carefully, and it could result in doubling the UK's space budget from £100m a year at present, in the 1990s.

Michael Donne

## Last year the industry made a positive contribution of £1bn to the balance of payments

be privatised by next June.

"By then we shall have established a reliable track record of profitability and we will, I am confident, be in an internationally competitive position, capable of convincing investors that Rolls-Royce is the company they should invest in."

The 1984 profit of £28m before tax had been more than tripled in 1985 to £81m. "Now I know that sounds a lot of money, but it really is not enough for us to be making in what was quite a good trading year. To secure our future we need to achieve something like double that figure," Sir Francis said.

But he claimed Rolls-Royce was now in "quite a strong position," with the workforce reductions that had already taken place, the wider range of engines, the solid technology base, and the substantial investments which had been, and continued to be, made in new machine tools and computers. Above all the company had a

trially.

Today, it has a flourishing business in three broad areas. One is the manufacture of civil and military aircraft, including the civil 330 and 360 twin turbo-prop commercial transports, and now also the Brazilian-designed Tucano basic trainer for the RAF.

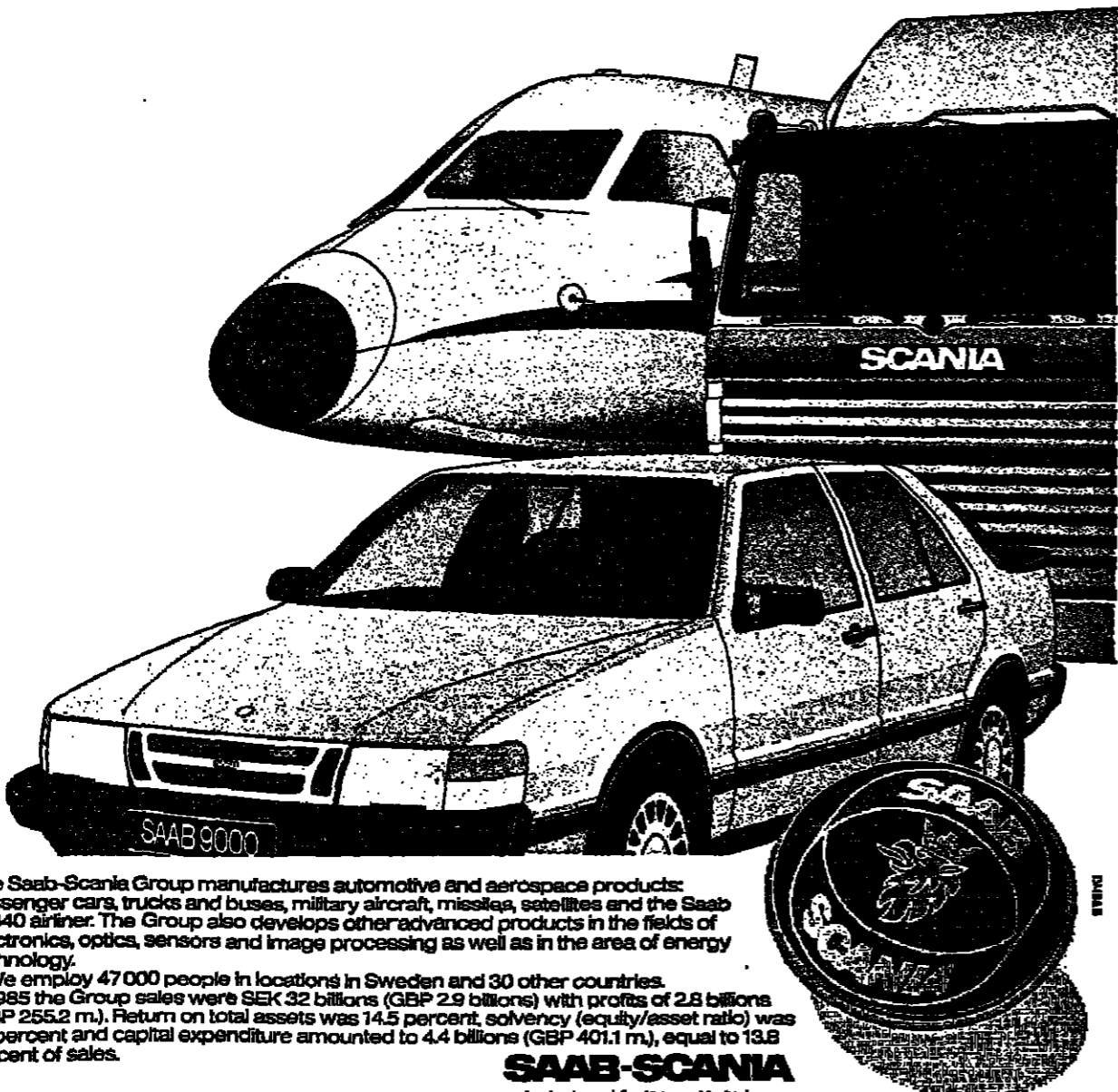
In guided weapons, the company makes the Seacat ship-to-air weapon, the Blowpipe and Javelin man-portable anti-aircraft missiles and now also the new Starstreak high-velocity air defence weapon, selected by the British Army.

In aerostructures, the company undertakes the design and manufacture of parts for a wide variety of overseas aircraft, such as the Boeing 747 Jumbo jet, 757 and 737-300 jets, and wings for the Fokker F-28 and now also the new Fokker F-100 twin-jet.

It also undertakes extensive jet engine nacelle "podding" work on the Rolls-Royce RB-211 engines for the Boeing 747 and 757 airliners, the Avco Lycom-

## We make cars, trucks, aircraft and money.

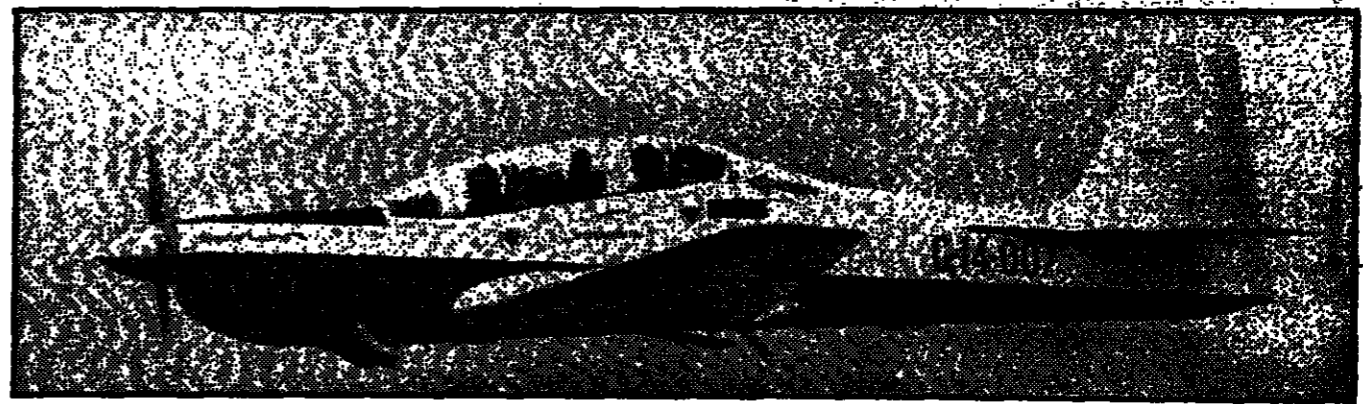
And every year we make more of them. So much so, that for the last five years Saab-Scania Group sales have increased by an average of 18% and profits have risen by an average of 24% per year. This is the result of a determined policy of concentration and specialization in products for well defined market sectors. Areas such as high performance passenger cars, trucks for heavy transport and aircraft for regional traffic. In these areas Saab-Scania products have earned a reputation for technical innovation and quality. In the field of specialized transport technology the symbol of Saab-Scania is the sign of technical innovation and financial strength.



The Saab-Scania Group manufactures automotive and aerospace products: passenger cars, trucks and buses, military aircraft, missiles, satellites and the Saab SF340 airliner. The Group also develops other advanced products in the fields of electronics, optics, sensors and image processing as well as in the area of energy technology. We employ 47,000 people in locations in Sweden and 30 other countries. In 1985 the Group sales were SEK 32 billion (GBP 2.9 billion) with profits of 2.8 billion (GBP 255.2 m). Return on total assets was 14.5 percent, solvency (equity/asset ratio) was 50 percent and capital expenditure amounted to 4.4 billion (GBP 401.1 m), equal to 13.8 percent of sales.

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Leaders in specialized transport technology.

For further information please write to Saab-Scania AB, Corporate Communications and Public Affairs, S-681 86 Linköping, Sweden.



The Brazilian Embraer Tucano basic trainer is now being built in quantity by Short Brothers for the RAF

## IN AVIATION FINANCE THIS IS NO TIME TO BE FLYING A KITE.

New tax legislation, unpredictable cycles and interest rates, newer aircraft technology, the reticence of airlines to commit themselves for too long to a particular aircraft type... These are just a few of the factors casting a shadow over aircraft resale values in the 1990's.

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The US

# Sharp variations in earnings

AEROSPACE manufacturing in the US has become increasingly polarised in the past decade or so, divided between the very few companies which still have a part to play in the commercial airliner sector and those which are connected with the defence or space business.

Growth in the two areas tends not to run in tandem, and the differences in the cyclical behaviour of the two industries have begun to show up, particularly in recent months.

In the commercial airliner business, 1985 looks already as though it will be an outstanding year, with both orders and production up on the healthy figures generated in 1984 as the world's airlines moved into a period of extensive aircraft replacement.

The benefits of this boom, however, are spread very thinly in terms of airline manufacturers and are concentrated on the two big US companies which remain in large-scale manufacturing—Boeing and McDonnell Douglas. Between them, these two companies announced a total of 507 airliner orders last year.

The pronounced cyclical swings of commercial airliner production are amply illustrated in Boeing's financial performance over the last five years. The Seattle-based group plummeted from peak earnings of \$400m in 1980 to a low of \$28m in 1984, and back up to \$260m last year.

That figure looks set to be easily exceeded this year, when the group achieved net income of \$517m in the first six months against \$346m in the same period of last year.

These sharp variations in earnings, along with the economies of large-scale production, which demand heavy

capital commitments and tight managerial controls, have forced most of Boeing's early rivals out of the business. Even McDonnell Douglas has only a limited range to offer—essentially the MD-80 twin-engine 150-seater—leaving Boeing as the only producer in the world offering a variety of

Airbus consortium in a deal aimed at mounting a concerted attack on Boeing's pre-eminent position.

Boeing itself, despite its enormous financial strength—\$2.8bn cash available at the end of June—is also moving in the direction of joint ventures, partly in an effort to

years ago. But it will put pressures on margins—a point which was evident in the first quarter figures from some of the big military suppliers.

Additionally, several of these companies are having to trim back prices because of the Pentagon's recent accusations of inflated billing on some contracts, and they stand to lose from the proposed new tax Bill going through Congress.

The rundown of military contracts may be one of the reasons why several companies appear intent on diversifying either outside or inside the defence sector. McDonnell Douglas, for example, bought Hughes Helicopter two years ago; and General Dynamics, having swallowed Chrysler's tank business in 1982, acquired Cessna, the light aircraft manufacturer, last year.

More recently, Lockheed, which in the last decade has turned itself from a civil aircraft group into a pure defence and space company, has acquired Sanders Associates, a high-technology electronic warfare company. Analysts believe this will allow Lockheed to build up a military electronics business that will enable it to offer complete weapons systems to the Pentagon.

The third main sector of US aircraft manufacturing—general aviation—has been in decline since the 1982 recession and seems stuck in the doldrums for the time being. These small and executive aircraft manufacturers have suffered from the cutbacks in corporate overhead spending, while their own costs have been hit by increased insurance premiums against product liability.

Last year the general aviation specialists—Beech, Fairchild Aircraft, Gates Learjet,

## An outstanding year is expected for airliner production but defence orders are now falling

products from the 100-seater 737 to the Jumbo 747, capable of taking up to 550 passengers.

Boeing recently added to its potential range by acquiring De Havilland, the Canadian manufacturer of short take-off and landing and other commuter aircraft, a deal which will add a number of short-haul, propeller-driven aircraft to its present range.

Some analysts now question whether McDonnell Douglas will remain indefinitely in the airliner business, at least as a totally independent manufacturer. The St. Louis company already has about 70 per cent of its sales tied up in military and government contracts, has had trouble selling the concept of its planned new MD-11, a 300-seat derivative of the DC-10, and has been diversifying recently with acquisitions in the information systems sector.

One way of competing with its larger rival would be through joint ventures, and there have been strong suggestions that the company might get together with the European

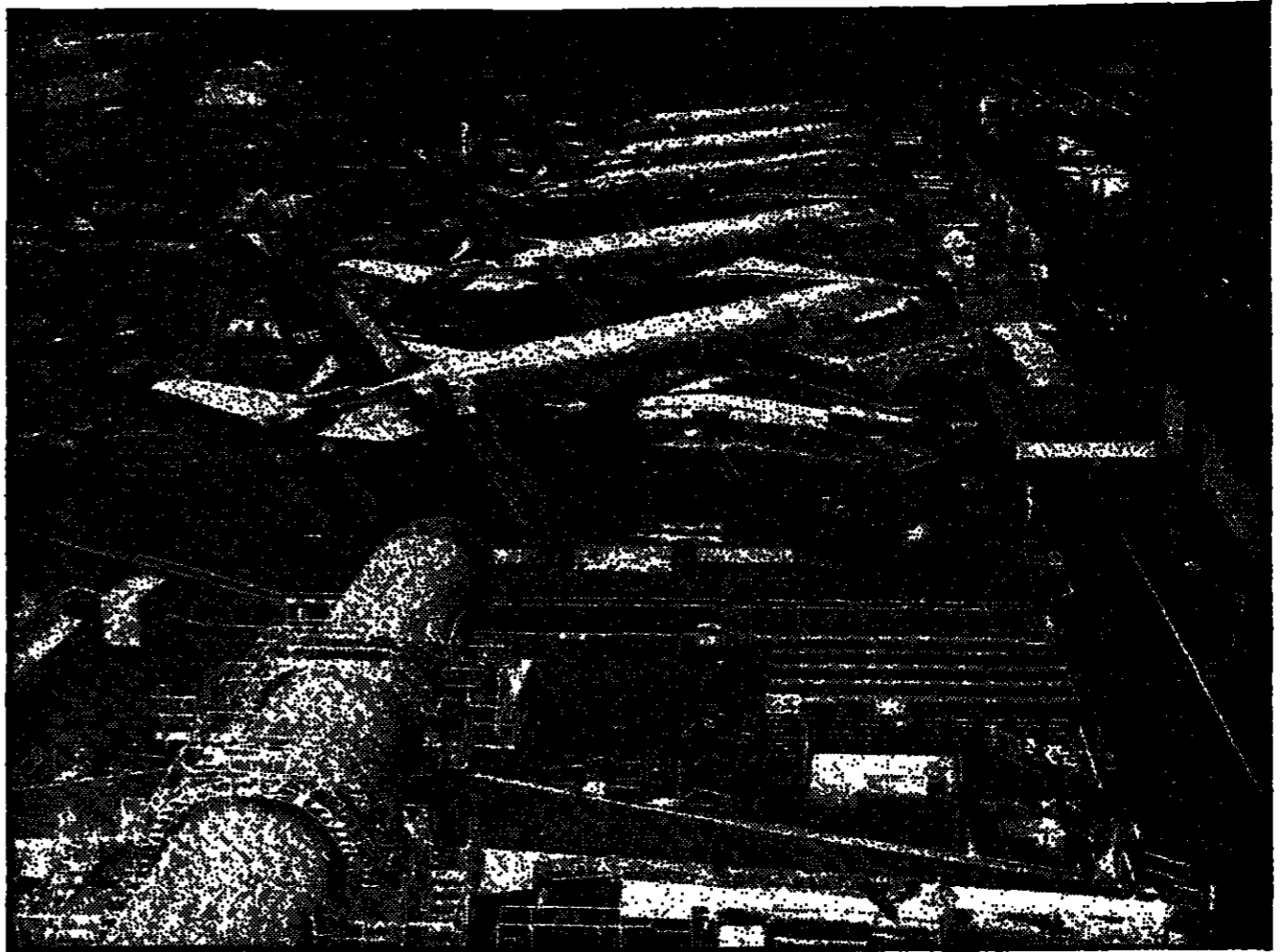
harness additional resources for the next generation of sophisticated and costly airliners now being plotted in the design studios.

A Japanese group has recently signed a contract to take part in the development of the 747, Boeing's planned new 150-seater prop-fan aircraft, which could cost up to \$8bn to bring to production.

In the defence sector, the aerospace companies are now unquestionably moving into a period of declining orders after the exceptional boom that started with the defence build-up in the later years of President Carter's administration and that was given a further boost by President Reagan.

In the 1986 fiscal year, the defence budget has been trimmed from \$314bn to \$296bn in 1985, and Congress seems determined to support a further decline in authorised spending in fiscal 1987.

This will not spell poverty for the military contractors since defence spending is still considerably higher than a few



Final assembly line of the Boeing 757 twin-engine short to medium haul jet airliner at the company's Renton, Seattle, factory

Gulfstream, Cessna and Piper—delivered just over 2,000 aircraft, the lowest figure in 40 years, and in the first four months of this year they suffered further setbacks.

The value of orders in this period fell by almost 50 per cent from the 1985 figure, while deliveries were down more than 30 per cent, according to Wall Street estimates.

Several of these companies are owned by larger corporations capable of absorbing the

financial downsizing. But significant questions have emerged over the future of Gates Learjet and Fairchild, both of which have been in loss recently.

Fairchild's problems led it to withdraw from a joint airliner development programme with Saab-Scania of Sweden earlier this year, and it is now pinning its hopes on the T-46 trainer that it is developing for the Government, but which has not yet received final approval.

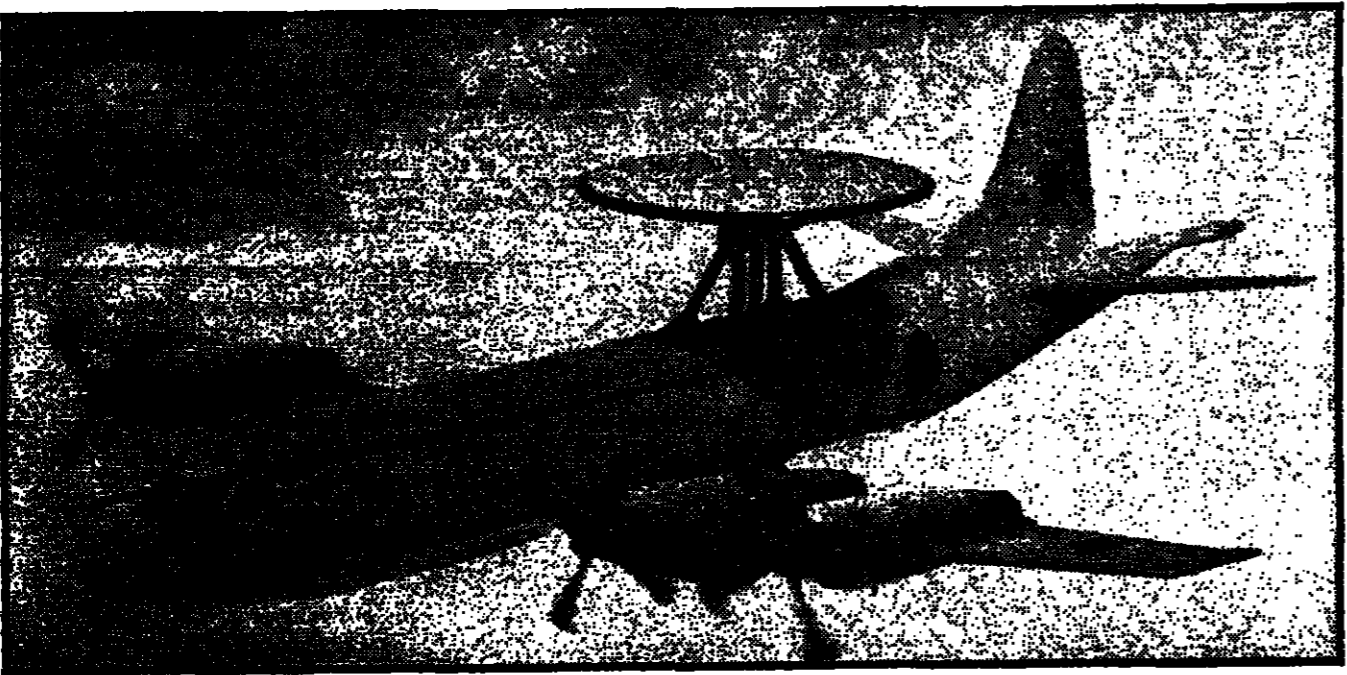
Gates Learjet has suffered particularly heavily from the collapse of the executive jet market, and is now diversifying as a contractor to the space programme and the military.

Although the troubles of general aviation are not expected to go away soon and the military business is not quite what it has been, the US aerospace sector continues to be one of the bright spots in the economy. It is the country's most successful exporting indus-

try, accounting for \$18.8bn of overseas sales in 1985, against only \$5.6bn of imports.

Total sales are now approaching \$100bn, and in recent years it has been an important job creator, increasing employment from 69,000 in 1984 to 75,800 last year. In the current year, the US Department of Commerce expects the industry to grow at an inflation-adjusted rate of 4 per cent.

Terry Dodsworth



LEFT: The Lockheed-California Company's P-3 Orion modified for Airborne Early Warning and Control (AWACS) missions has been offered to the UK Ministry of Defence as an alternative to the Nimrod programme. The P-3 is currently operated as a maritime patrol aircraft by 10 nations including the US. Right: The Pitts series of single-seat biplanes, built by Christen Industries of Wyoming, has been used extensively for aerobatics for some years. The picture shows a Pitts S-2S as used by the British team in the recent Volare World Aerobatics Championships in the UK.

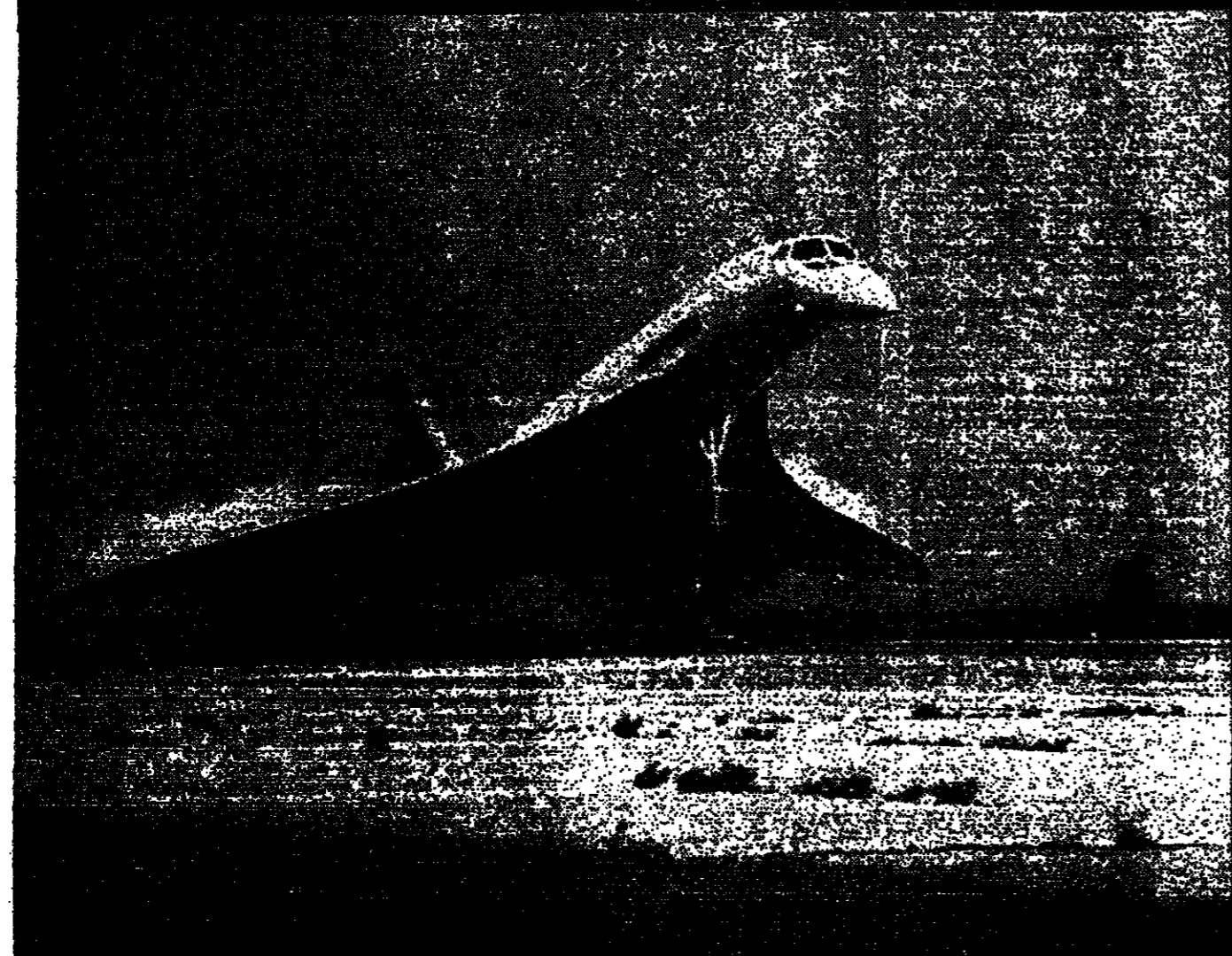


### US aerospace companies—1985 results

	1985 sales (\$m)	1984 sales (\$m)	% change on year	1985 earnings (\$m)	1984 earnings (\$m)	% change on year	1985 total backlog (\$bn)	1984 total backlog (\$bn)	1984 funded backlog (\$bn)
Boeing	12,630.0	11,129.0	+13.5	566.0	390.0	+45.1	26.7	24.7	21.5
McDonnell Douglas	11,477.7	9,682.6	+18.5	345.7	325.3	+6.3	23.9	16.6	15.0
Lockheed	9,535.0	8,113.0	+18.0	401.0	344.0	+17.0	17.9	9.0	9.4
Northrop	5,956.0	3,637.2	+63.0	214.4	186.9	+14.7	n.a.	4.6	2.4
Grumman	3,998.9	2,603.6	+53.6	81.5	108.4	-24.8	5.4	n.a.	n.a.

Research: Rivis Nachoms.

## 10 years old, and still 20 years ahead



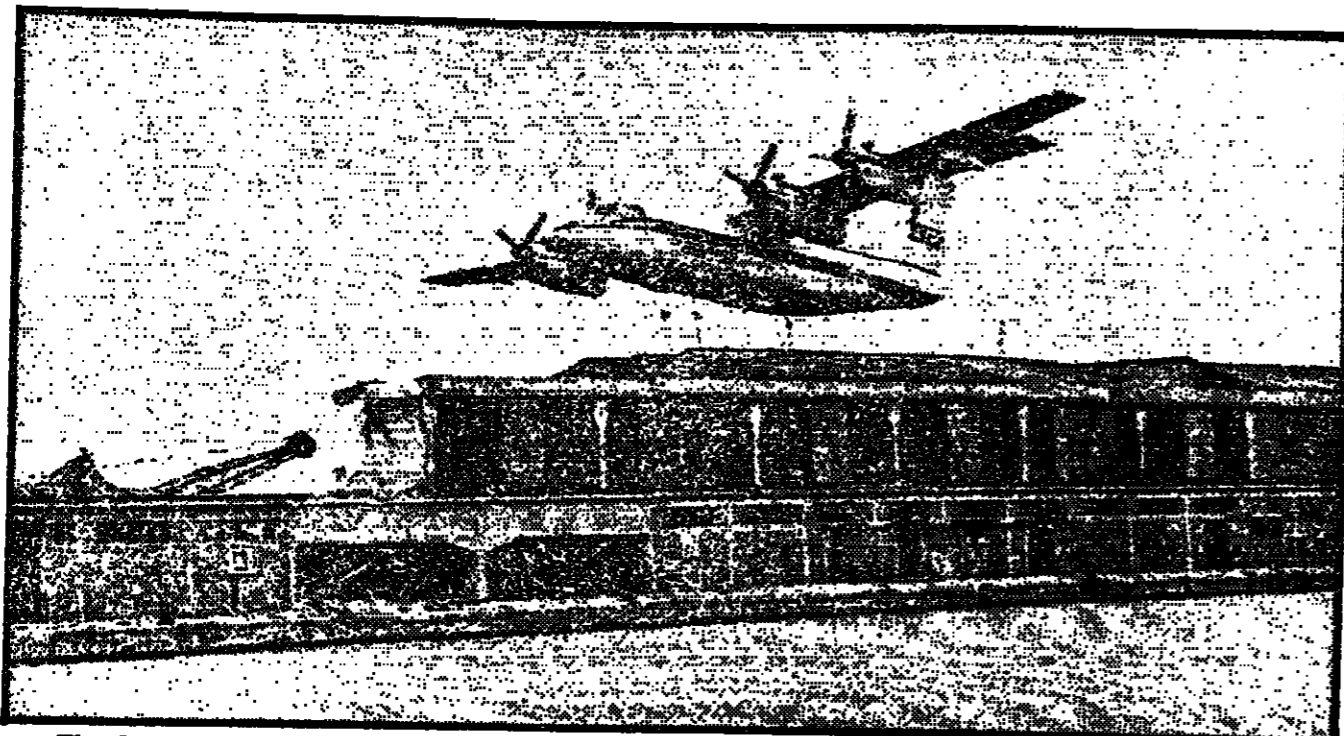
At Aerospatiale, addressing the exciting aerospace challenges of tomorrow means capitalizing on the daring and innovative technologies we pioneered with Concorde. Projects like Hermes, for example. When it enters service in 1995, Europe's Spaceplane will be the direct beneficiary of more than three decades of commitment to advanced aeronautical research and design. Not to mention Concorde's outstanding track record of in-flight performance and reliability. But at Aerospatiale, continuity means looking further than just a decade ahead. That's why we're hard at work on Concorde's successor—a hypersonic transport that will dramatically change the way people travel, as early as the year 2000.

\*In cooperation with British Aerospace.

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# Aerospace 14



The de Havilland (Canada) Dash 7 four turbo-prop, short-haul and short take-off/landing airliner

## Canada

### Continuing role for public purse

THE FEDERAL government's privatisation programme is reshaping important parts of Canada's aerospace industry, but the role of the public purse will continue to be vital for the future.

The industry comprises more than 100 companies, some subsidiaries of international concerns, grouped together in the Aerospace Industries Association of Canada. Sales will be about \$4.5bn in 1986, about 80 per cent for export, and employment more than 46,000. Gradually, these companies are becoming more reliant on defence orders, especially from the US.

The Progressive Conservatives came to power late in 1984 and inherited the problems of the two airframe companies, Canadair in Montreal and de Havilland Canada in Toronto. Both have been taken over by Ottawa to save them from collapse during the 1982-83 recession.

In effect, Ottawa assumed nearly C\$2bn in development costs for Canadair's Challenger executive jet, then having teething problems, and for DHC's Dash-7 and Dash-8 commuter aircraft.

The new government decided to take the privatisation route. First it moved to sell DHC to Boeing in preference to a Canadian consortium. Initial contro-

very has died down as order booklogs for the twin-engine Dash-8 have risen and Boeing has moved to speed up development of the stretched Dash-8 to carry more than 50 passengers—creating a more competitive aircraft.

The choice of the buyer for Canadair is near. Industry reports persist that the government will choose Bombardier, the Quebec-based manufacturer of heavy transit equipment, snowmobiles and defence products, over the rival Dornier consortium from West Germany in partnership with Montreal.

Whether Canadair would get a valuable contract for the maintenance of Canada's F-18 fighters is not clear, but the choice of Bombardier would help the government's sagging popularity in Quebec though it may peeve some other parts of the country who Canadair will require a steady base of defence activity to carry the challenge in the medium term, since the market for high-performance inter-continental jets will remain volatile, and competition from the US and Europe strong.

The government has just accepted a solution for the Bell Textron (Canada) helicopter plant at Mirabel near Montreal, where C\$250m has already been

invested. Because the light-twin helicopter market has remained so sluggish, Bell Textron Canada is moving production of two series of commercial light helicopters from Fort Worth to Montreal, while it continues development work on the Canadian-engine twin 400 model and on the 440-twin which will use large amounts of composite materials.

The first Jetrangers and Longrangers will move out the plant early next year, and it may yet have a role in the C\$2bn Sea King helicopter replacement programme for the coastguard.

Both the federal and Quebec governments will continue to make support payments to complete the Mirabel plant, in parallel with Bell Textron (Canada), but defence orders will be important for its long-term success.

A smaller helicopter plant in Ontario, owned by the West German-controlled MBB Aerospace, has made a remarkable comeback from the recession. Its products are broader and productivity is higher. The biggest single unit, Pratt and

Whitney Canada, is shifting gradually towards fully computer-controlled manufacturing.

The company is shifting production of its small fanjet engines to Toronto to make room in Montreal for its PW100 series for commuter aircraft. It maintains Canada's second-largest industrial research operation in Montreal and Toronto.

The industry is roughly divided with half in Quebec and the Maritimes and half in Ontario and the West. McDonnell Douglas Canada in Ontario is busy making wings and other parts for the parent's successful MD80 series, and a host of parts and materials suppliers, engineered products, avionics and electronics producers are gearing up for better times.

The low-level air defence system contract, the Sea King replacement and Canada's space station programme will provide several billion dollars of underpinning in the medium-term. But one conspicuous success is the CAE Electronics division of CAE Industries, which has carved itself an enviable niche as one of the world's major makers of simulator equipment for commercial airlines and military use.

Robert Gibbens

## Soviet Union

### Designs match best in the West

IN SIZE and scope the Soviet aerospace industry clearly matches that of the US, across the whole spectrum of civil and military aircraft engines, guided weapons and spacecraft, as well as in avionics and related industries.

Detailed information is hard to obtain, but it may even exceed the US aerospace industry's output in some areas, such as tactical military combat aircraft, reflecting the greater proportion of Soviet gross national product devoted to military production of all kinds.

This is suggested by statistics prepared by the US Department of Defence, comparing aircraft production in the Soviet Union and Nato countries. They show that in 1984 the Soviet Union produced some 900 fighters and fighter-bombers, against Nato's 525; 300 transport aircraft, against Nato's 250; and some 870 helicopters, against Nato's 270.

The total of Warsaw Pact military aircraft is nearly 13,000, compared with Nato's 11,000, while the number of Warsaw Pact combat aircraft in place in Europe exceeds that of Nato by a substantial margin.

Nor is this advantage in numbers due in any way to lower quality in a bid for quantity. Many current Soviet civil and military aircraft designs, as seen at recent western air displays, are of a high standard of technical excellence.

This is a radical change from the position some years ago when, undeniably, the manufacturing finish on some Soviet aircraft shown in the West was inferior to that of the US and UK aerospace industries.

Clearly, the Soviet Union has paid considerable attention to quality and operational performance, and today its designs match the best available in the West.

This is probably due to two factors: first, the substantial amount of money devoted to defence production in the Soviet Union, and particularly to military aircraft, and second, the massive efforts made to acquire modern Western technology.

In many cases, this is not difficult. Freedom of informa-

tion in the West means that enormous quantities of data about civil and military aircraft is readily available in the technical press; while the big air shows, such as Farnborough, Hanover and Paris, pour out information, especially on civil aircraft, in a manner unknown in the Soviet Union.

While so-called "missions" come to those air shows, and major new Soviet aircraft are occasionally displayed as publicity exercises, the primary purpose is to gather as much information as possible about what is going on in Western aerospace, while offering the minimum information in return.

Where information cannot be obtained in such an open manner, the Soviet Union does not hesitate to use other techniques. The US government, in its most recent analysis, *Soviet Military Power*, states: "Through both legal and illegal acquisition of modern western production techniques, the Soviets are establishing more efficient, integrated and technologically advanced capabilities for the production of highly sophisticated weapons."

The same document says that "throughout the last decade, the Soviet military has absorbed an increasing share of the nation's gross national product, a share now estimated at 15 to 17 per cent." This compares with about 6-7 per cent for the US.

The sustained Soviet economic commitment to the military is further revealed by the flow of resources to, and growth of, the machinery industry. This key sector of the economy, broadly divided into military and civilian machinery production, is the source of the Soviet Union's military weapons, civilian investment goods and consumer durables.

The machinery sector continues to experience the most rapid growth in the economy; in 1984, when overall industrial growth was 4 per cent, the machinery sector expanded by some 7 per cent," says *Soviet Military Power*.

"The military machinery proportion of this sector now accounts for 60 per cent of total machinery output, and has been receiving nearly all the additions to the machinery sector's

labour force, leaving little or no labour growth for the civilian sector."

Whatever the Soviet methods of acquiring information, the fact remains that the output of its aerospace industry is formidable. This applies as much to space hardware as it does to civil and military aircraft, engines and guided weapons.

The structure of the industry is different from that of the West, where many individual companies, either state-owned or private, compete for major orders. In the Soviet Union, the industry consists of a number of major "design bureaux," most of which were established by famous designers whose names are perpetuated in the organisations, and which specialise in particular types of aircraft. Competition is kept to a minimum.

These aircraft bureaux, in alphabetical order, are:

Antonov, based at Kiev, was founded by the late Oleg Antonov. It is primarily a builder of transport aircraft for civil and military purposes. Some are unique in design, such as the An-72 twin-jet short take-off and landing transport, with engines mounted on top of wings that are set high on the fuselage. The latest Antonov product is the An-124 Condor, a strategic heavy transport that is the heaviest transport aircraft in the world, and which is expected to be seen at Farnborough.

Beriev, founded by the late Georgi Beriev, and based at Taganrog, is primarily a producer of amphibious aircraft.

Kyushin, founded by the late Sergei Kyushin, is also mainly a transport aircraft builder. Its most famous recent products include the IL-86 four-jet wide-bodied transport, of which a longer-range derivative, the IL-86 is under development.

Kamov, originated by the late Nikolai Kamov, is primarily a helicopter producer.

MIG, the famous fighter-producer, was founded by the late Artem Mikoyan and Mikhail Gurevich. Its latest product seen in the west is the MIG-29 Fulcrum fighter.

MI, founded by the late Mikhail MI, is also a helicopter producer, but is engaged in bigger, heavier ones than those to the machinery sector's Kamov. They include some of

the biggest in the world, such as the Mi-26 eight-bladed rotor heavy-lift aircraft; and the Mi-10K, built for lifting heavy and bulky loads.

Myasischev, founded by the late Vladimir Myasischev, has a limited output which includes the big four-jet strategic bomber, tanker and reconnaissance aircraft.

Sukhoi, named after Pavel Sukhoi, is a major fighter builder, whose latest venture is the Su-27 Flanker counter-air fighter.

Tupolev, founded by the late Andrei Tupolev, is a major builder of transport aircraft and bombers. Major ventures have included the Soviet rival to the Concorde, the Tu-144, which had only a short period in service. Tupolev's reputation is more securely built on such major airliners as the Tu-154 jet, and on jet bombers as the supersonic Blackjack.

Yakovlev was founded by Alexander Yakovlev, who still runs it. Its versatility has produced such aircraft as transport (the Yak-42, tri-jet Clouber jet, and on jet bombers like the Yak-38 vertical take-off ship-borne fighter (Forger A); and light aerobatic and sporting aircraft.

Soviet aero-engine capability is also substantial, with such major bureaux as Lotov, Ivchenko, Kuznetsov, Lotarev and Soloviev (although there are others) meeting the entire needs of the aerospace industry.

What is significant about these manufacturers is that they are all substantially self-contained. Unlike the West, where there is a major and growing international trade in aircraft parts and engine equipment, and even in manufacturing collaboration, the Soviet Union buys little from outside, although some procurement from the West is not unknown. This is partly due, however, to the western strategic arms embargo on trade in sensitive technological items to the Soviet Union; although, as already mentioned, the Soviet Union conducted a considerable clandestine business in acquiring western technological know-how.

Michael Donne



The Soviet Union's Antonov An-124 Condor, the heaviest aircraft now flying in the world

## Japan

### Strong bid for self-sufficiency

JAPAN IS NOT yet known worldwide for its aerospace industry, but it soon will be. The country makes several types of military and civil aircraft and is about to become self-sufficient in communications satellites and the rockets to launch them.

Sales of the aircraft industry reached ¥500bn in 1984 and the industry hopes that figure will grow to ¥2,000bn a year by 2000. The industry has grown mainly through licence agreements with US and European airframe and engine makers to make military aircraft and helicopters.

The leading companies, Mitsubishi Heavy Industries (MHI), Kawasaki Heavy Industries (KHI) and Ishikawajima-Harima Heavy Industries (IHI) have also become increasingly important suppliers of components for US airframe makers.

However, Japanese industries as a rule are not content to rely on others for technology and the aerospace industry is no exception. The government has generously supported innovation in this sector and is likely to continue to do so.

Japan's most novel aircraft project to date has been the ¥29bn Asuka fan jet short take-off and landing (Stol) commercial aircraft. The development was started in 1977 by the National Aerospace Laboratory of Science and Technology Agency, and the aircraft, built by KHI, had its maiden flight last October.

Though its total weight is 33 tonnes, the Asuka can take off and land on a 700-metre runway. The main innovation is the installation of the engines above the wing to generate lifting power two or three times that of conventional jet aircraft. The result is that the Asuka can land or take off at only 130 kph. The Asuka is strictly a re-

search aircraft, but the agency hopes it will lead to commercial development within three years or so. KHI is also the lead contractor for the totally indigenous T-4 jet trainer. More than 200 are to be manufactured for the Defence Agency this year following successful test flights last year.

On the engine side, the main project is the International Aero Engine (IAE) consortium set up six years ago to develop the V2500 engine for short- and medium-range aircraft. Three Japanese companies are participating. Tests on the first experimental model of the engine began last December.

Japan launched its first communications satellites in 1983 for use in improving communications with the country's outlying islands. The CS-2 satellites were small (850 kg) but more than half of the technology and hardware was Japanese, with most of the know-how coming from Nippon Denki, Toshiba and Mitsubishi Electric.

The first 100 per cent Japanese satellite is due to be launched in 1991. Significantly, it will be launched in Japan's first entirely home-made large rocket.

Japan's space agency has long rocket experience going back to 1975 when it launched the small N-1 rocket. This month it was due to launch its H-1 rocket, which is powerful enough to put a 550 kg payload into synchronous earth orbit.

Until now, all Japanese rockets have relied almost entirely on US technology, and so Japan has not been allowed to launch satellites for third countries or equipment. But the H-2 rocket now under development relies entirely on Japanese technology and is intended to put a 2,000 kg payload into synchronous orbit by 1991.

Despite the recent problems in the US and European space programmes, Japan is pushing ahead with its programme to build a pressurised space

module (JEM). MHI is the coordinator on the ¥240bn project, which will be part of the planned US manned space station.

Even though Japan has a huge trade deficit in the aerospace sector, it is not averse to regarding this as a sector in which its technology is superior and so expects Japan to buy American rather than try to catch up.

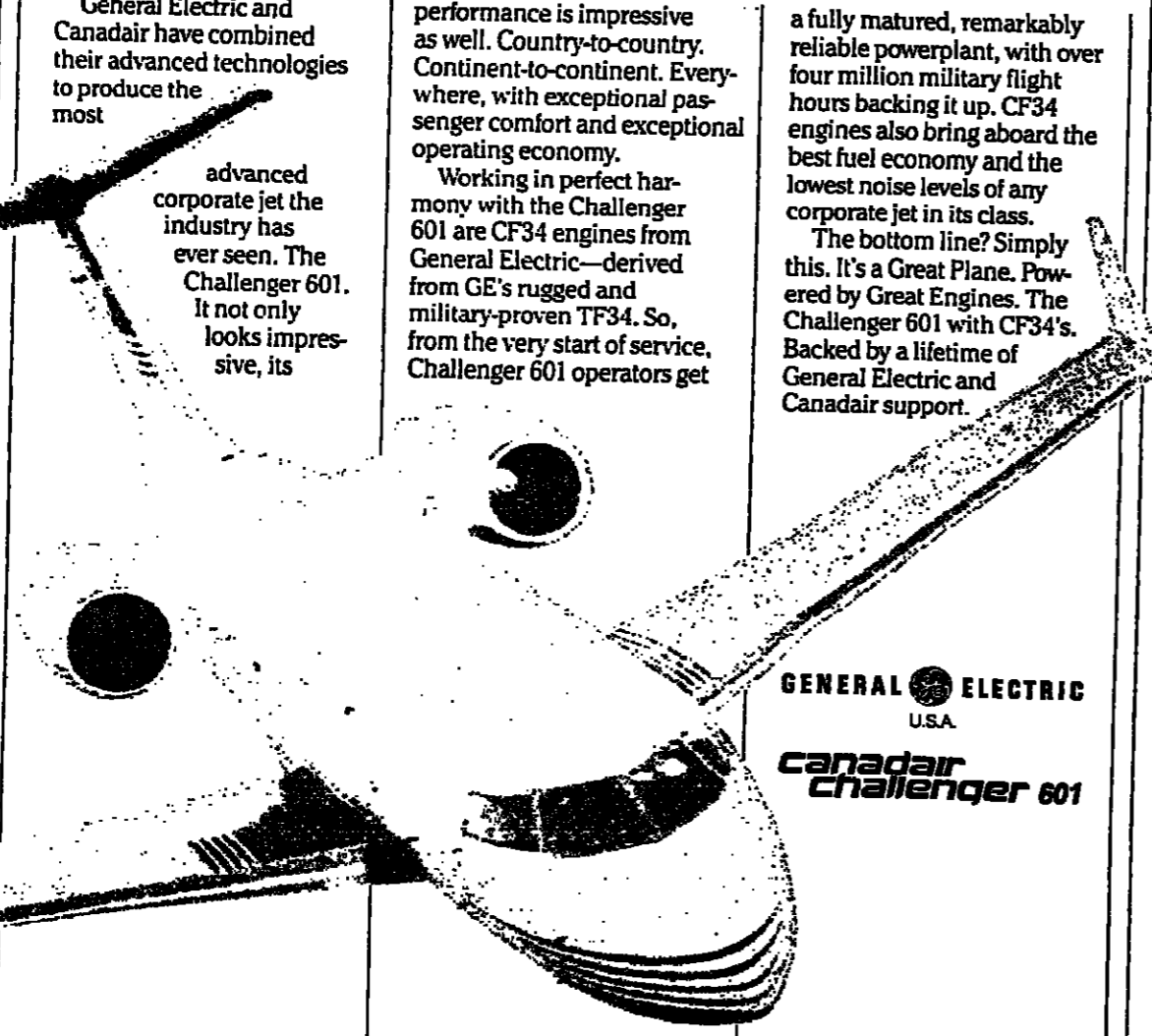
Last month Mr Malcolm Baldrige, the US Commerce Secretary, complained again that Japan was trying to avoid buying US satellites.

But the main focus of this tension today is the Japanese defence Agency's desire to replace its ageing fleet of 70 ageing F-15s. The industrial establishment is pushing hard for a decision in favour of the F-16, but the US wants Japan to buy F-16s or F-18s.

Ian Rodger

## Great Plane. Great Engines. Great Combination.

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GENERAL ELECTRIC  
USA  
Canadair  
Challenger 601

Aerospace 15

France

# Hard choices on collaboration

THE FRENCH aerospace industry is approaching a crossroads in the sky. The sector, which has long been one of the most dynamic and internationally successful areas of French industry, faces a number of difficult decisions over foreign collaborative projects which could spell make or break for the 1990s.

The industry has managed up to now to balance the alternative challenges of competition and collaboration with a reasonable degree of success.

Aerospatiale, the state-owned aerospace group, has become a pillar of European collaboration. It has forged strong links with Messerschmitt-Boelkow-Blohm of West Germany and with British Aerospace over projects as diverse as the European Airbus and anti-tank missiles. The longer-standing contact with MBB—which goes back to the birth of post-war Franco-German aerospace and arms co-operation, at the end of the 1950s, are underlined by the links between the two companies in satellites as well,

whereas British Aerospace's satellite agreements are with Matra.

On the other hand, Dassault-Breguet, the military aircraft maker in which Mr Marcel Dassault, its founder, never loosened control up to his death in April, has provided a counter-example by forging a go-it-alone path.

The Dassault Mirages throughout the 1960s and the 1970s became symbols and sometimes even promotional tools of France's independent foreign policy.

Now, however, faced with increasingly aggressive American competition on world aerospace and defence technology markets, and shrinking budgets among some of France's traditional clients in the Third World, Dassault clearly is having to change course.

Two events illustrate the increasing pressures faced by the French industry. The presence of Chancellor Helmut Kohl at the Hanover air show in June backed up the belief that the

German aerospace industry will be trying to take a much larger share of the cake in future Franco-German collaborative projects.

Strong hints have already occurred in recent months as a result of difficulties with the Franco-German project to build a joint attack helicopter for the 1990s, as well as wrangling over the two new Airbus projects—the A330 and A340—currently on the drawing board.

The other event was Dassault's offer at the Jakarta air show a few weeks ago to help construct a mooted fighter to be built by the fledgling Indonesian aerospace industry. The idea of Dassault offering its services as a sub-contractor "would have been unthinkable even a few months ago," says a top executive at another big French aerospace group.

Dassault's stubborn refusal to give up its claim to leadership in the long-running negotiations over the European fighter aircraft last year now appears to many in the French industry

to have been a mistake.

Dassault is now looking for possible collaborative agreements with northern European countries including Belgium, the Netherlands, Norway and Denmark, which could join in building a developed version of its Rafale prototype which made its maiden flight in July.

Mr Andre Giraud, the French Defence Minister, has rejected the idea, put forward by President Mitterrand last November, that France could take a small stake in the four-nation fighter to be built by Britain, West Germany, Italy and Spain.

This means that the Rafale follow on and the EFA will both be slugging it out on world markets in the 1990s—a prospect which adds to the possibility that Dassault will try to make the planned lighter version of the Rafale as attractive as possible for export customers.

One intriguing idea being examined is that Dassault could go into partnership with a US company such as Northrop for work on a 1990s fighter. A strong example of US-French co-operation has already been set by links between Sncma and General Electric in the aero engine field.

As Paris and Bonn do their best for political reasons to keep tension between their two countries' aerospace industries under control, France might find some logic in seeking greater rapprochement with the US aerospace industry in coming years.

For instance, French officials strongly back Airbus Industrie's contacts with McDonnell Douglas over possible co-operation—although they say there is no question of allowing any delays for the A330 and A340 programmes.

Paul Betts



The Saab SF-340 twin turbo-prop regional and commuter airliner is now increasingly used in Western Europe, the US and elsewhere. This line-up of 10 SF-340s shows the Crossair, Switzerland, fleet

Sweden

# Shift to civil aircraft building

SWEDEN'S AEROSPACE industry is continuing to shift the emphasis from military to civil aircraft production, but the past year has proved that such a transition is not always easy.

The centrepiece of SAAB-Scania's expansion into the civil sector is the SF-340, a 35-seater twin turbo-prop commuter aircraft, built in collaboration with Fairchild Industries of the US. Work on the joint venture began in 1979 when SAAB saw it was becoming dangerously over-dependent on orders from the Swedish Air Force at a time of rising military R&D and production costs, and restricted defence spending.

When the SF-340 went into production in 1984, it also conveniently covered a hull between the company's production phase-out of the Viggen fighter in the mid-1980s and start-up of the multi-purpose JAS 39 Gripen combat aircraft in the 1990s.

But a major problem appeared last November when Fairchild withdrew from the project, citing economic reasons, leaving SAAB with the burden of manufacturing the aircraft on its own. As a result, SAAB has had to invest an additional SKr 800m, raising its total project cost to SKr 2bn.

Although Fairchild paid SAAB \$25m when it dropped out of the project, this only partially covers the cost for the construction of a new wing

factory and other production facilities necessary to complete the project. The new investment puts increased financial pressure on SAAB's flight division, which saw its net income drop from SKr 1,920m in 1984 to SKr 106m on sales of SKr 3.2bn in 1985 due to the start-up costs for both the SF-340 and the JAS 39.

It is now expected that SAAB must wait until the 1990s before making a profit on the SF-340. The break-even point, previously estimated at 200 aircraft, is now said to be at least 300.

This is a daunting figure considering that it represents 20 to 35 per cent of the world market for commuter aircraft and that SAAB must compete against the De Havilland Dash 8 and Embraer's Brasilia 120.

SAAB has delivered 61 SF-340s and firm orders take the total to 90. Those in service have been plagued by technical problems centring on the aircraft's General Electric CT7 engine, which have led to several temporary groundings. SAAB says the faults have now been corrected.

SAAB, meanwhile, is broadening its involvement in several international airliner programmes. The company agreed earlier this year to participate in the research phase of the McDonnell Douglas MD-81X prop-fan programme.

It has also joined the team of companies working on the Boeing 737 prop-fan airliner and will provide airframe parts, amounting to a 4 per cent interest in the project.

However, its planned participation in production of the McDonnell Douglas MD-11, for which it was expected to make the tail fin, is now uncertain following the Swedish government's refusal to provide a SKr 400m loan to cover investment costs.

With the SF-340 in full production and the company supplying airframe components for the MD-80 and the BAe 146, SAAB's business is now evenly balanced between the military and civilian sectors, the goal it set for itself at the beginning of the decade when more than 80 per cent of its sales were military-related.

But SAAB's—and Sweden's—single biggest aerospace programme remains the JAS 39, the first flight of which is scheduled for next year. The SKr 400m project calls for 140 aircraft to be produced for the Swedish air force by the end of the century. SAAB is responsible for 60 per cent of the work including airframe construction and systems integration.

Volvo Flyvmotor, the aero engine subsidiary of the automotive group, and GE are co-producing the single jet engine based on the F404 and LM

Ericsson is producing the radar, sensor and target acquisition systems as well as the cockpit display.

The programme was threatened last year by a cost overrun due to dollar-denominated foreign contracting, which includes GE, Lear Siegler (electrical flight systems) and British Aerospace (development of an all-composite wing). But the steady fall of the dollar against the krona this year has bridged the budget gap temporarily at least.

SAAB is pinning export hopes on the JAS 39 despite the fact that it has not successfully sold any combat aircraft abroad since the 30-year-old Draken. SAAB believes that the JAS 39's combined role as a fighter, ground attack and reconnaissance aircraft together with its easy maintenance—simple enough to be performed by conscripts—will make it ideal for smaller countries.

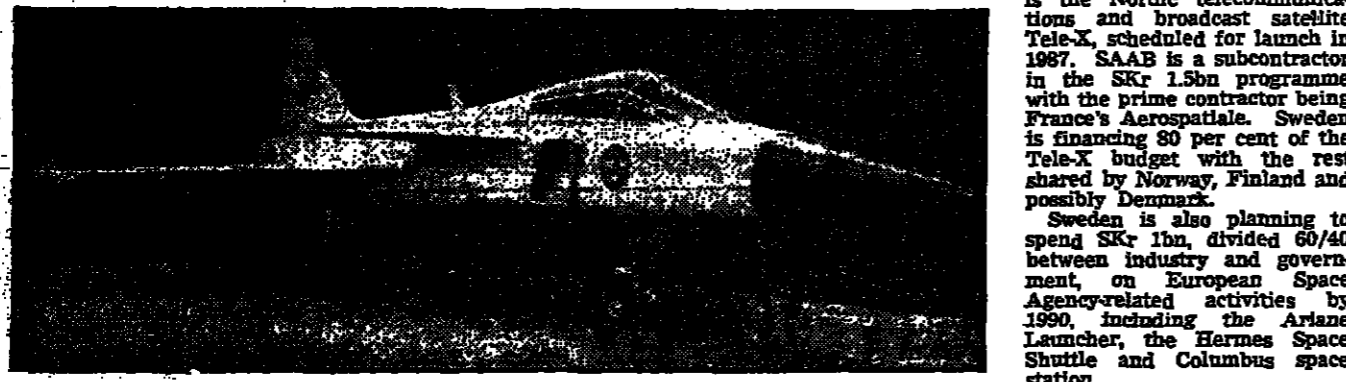
Volvo Flyvmotor has also been increasingly shifting its attention to the civil sector, which now accounts for 40 per cent of sales. It is cooperating with GE, Fiat and Whitney and Garrett on a range of engine programmes for passenger aircraft.

A milestone in the Swedish aerospace industry was marked this year with the launch of the scientific satellite Viking in February, the country's first. SAAB's space subsidiary was the project's prime contractor.

Sweden's next space project is the Nordic telecommunications and broadcast satellite Tele-X, scheduled for launch in 1987. SAAB is a subcontractor in the SKr 1.5bn programme with the prime contractor being France's Aerospatiale. Sweden is financing 80 per cent of the Tele-X budget with the rest shared by Norway, Finland and possibly Denmark.

Sweden is also planning to spend SKr 1bn, divided 60/40 between industry and government, on European Space Agency-related activities by 1990, including the Ariane Launcher, the Hermes Space Shuttle and Columbus space station.

John Burton



The Saab JAS-39 Gripen supersonic multi-role combat aircraft is now under development in Sweden, and will make its maiden flight next year

West Germany

# Strategic ventures outside Europe

WEST GERMANY'S leading aerospace concern, Messerschmitt-Boelkow-Blohm (MBB), spreading its wings in recent months, has embarked on two strategic ventures aimed at opening up important new non-European markets.

One big breakthrough came this spring at the Hannover International Air Show, where the group signed an agreement in principle with the People's Republic of China to jointly develop a new 60-85 passenger prop-fan regional airliner.

Beyond China, Mr Hanns Arnt Vogels, MBB's chairman, says he envisages a "worldwide demand" for as many as 1,000 of the aircraft in the 1990s, not least from developing countries.

A final decision on the \$1bn project, expected early next year, will follow feasibility studies now going on at a joint office in Hamburg.

Another important deal was announced in Jakarta. MBB, together with Boeing of the US, has signed an agreement with Indonesian State Aerospace to develop an 85/90-seat commercial aircraft, using prop-fan technology, to be in full production in the early 1990s.

The potential market, according to Indonesia's Minister of

Technology, Mr Jusuf Habibie could be as many as 1,200 aircraft.

These deals are particularly important in broadening the base for MBB which, with annual sales of about DM 6bn, has been operating largely in a European context.

Like other German aerospace companies, its expansion was cramped by post-war Allied restrictions which worked to the benefit of its British and French competitors. It has managed though to find a place in the international aerospace league by participating in a series of joint ventures.

The group is prime German contractor for both the European Airbus civil aircraft venture—in which it holds a 37.5 per cent stake—and the three-nation Tornado military aircraft.

On both the civil and military side, new-generation aircraft are being developed for the next decade. Deutsche Airbus, the consortium's German partner owned by MBB, is seeking to increase its overall participation in the two new civil projects, the short-to-medium-range A-330 and the long-range 340, which have a combined development cost of \$2.5bn.

Until now mainly responsible for the fuselage, Deutsche Airbus has said it is prepared to build other key sections, such as parts of the wing, helped by a long-term repayable grant of some \$1bn from Bonn.

There are strong indications that Luftwaffe, the state-owned airline, may emerge as the A-340 launch customer, boosting the economic viability of the project.

On the military side, production of the Tornado strike aircraft may stretch beyond the original 1989 date thanks to important export orders including some 100 fighters destined for Saudi Arabia. But another order, for 40 aircraft from Turkey, has apparently run into a dispute over financing.

The group's planned joint venture with France to build an anti-tank and combat helicopter has also been bedevilled by rows over equipment and specifications as well as rising costs.

In the longer-term of course, lies the new European Fighter Aircraft or Eurofighter project, in which both MBB and Dornier are to participate as the German partners to Britain, Spain and Italy.

Out of a total industry employment in West Germany of some 71,000, space-related activities are providing only some 4,300 direct jobs, although Germany is participating in the key European space projects including the recently announced \$3bn Hermes manned shuttle for the mid-1990s.

While MBB remains the country's dominant aerospace concern, it has been faced in the past year with a challenge in the form of a powerful new industrial concentration.

Daimler-Benz, the car, bus and truck builder which is one of the nation's biggest industrial concerns, last year took control first of Motoren-und-Turbinen-Union (MTU), which is the dominant aero-engines manufacturer, and then of Dornier, the then-family-owned aircraft producer.

The two companies had combined sales last year of DM 4.6bn. Moreover, it has recently emerged that Dornier may be preparing to take a 20 per cent stake in Deutsche Airbus from MBB, assuming the A330/340 project goes ahead.

David Brown

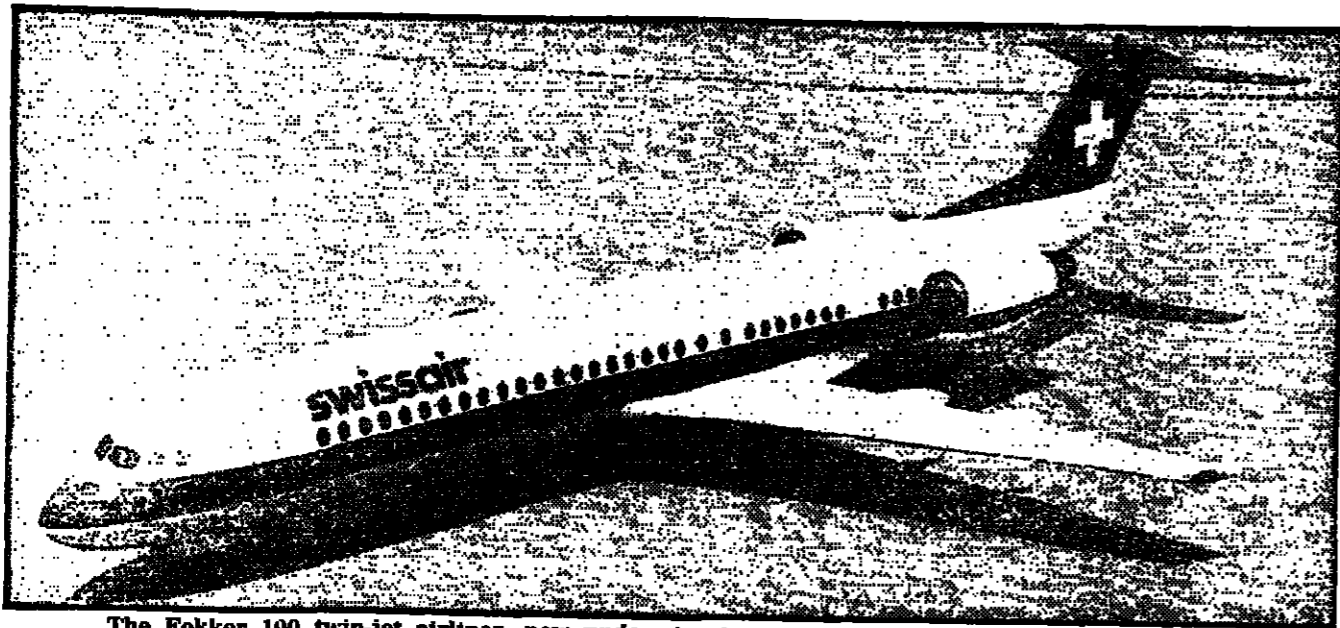
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The Fokker 100 twin-jet airliner, now under development, shown in the colours of Swissair, one of the major customers, with deliveries starting next year

Switzerland

Contracts agreed just in time

SWITZERLAND'S small aerospace industry, concentrated within the Oerlikon-Bührle group, has experienced much relief this year with three important contracts being concluded in the nick of time. Two were for the Pilatus PC-9 primary trainer and the third was a breakthrough order from Canada for Oerlikon's new Adats guided missile system. None contributed to the increase in net earnings in 1985 which persuaded Oerlikon-Bührle to resume dividend payments to shareholders after a two-year lapse, but they certainly helped to set the mood in which the Board took its decision. Pilatus secured its contracts with Australia and Saudi Arabia. The Australian order, valued at A\$230m, is a licensing deal under which 67 PC-9s will be built by Hawker de Havilland of Sydney for the Australian Air Force. It entails work equivalent to manufacturing between 15 and 20 aircraft for the Pilatus plant at Stans, just outside Lucerne, where the production line is being expanded. The PC-9 turbo-prop trainer was developed in collaboration with British Aerospace to bid for the RAF's order for a new primary trainer. It suffered a setback when Britain's Defence Ministry decided to award the contract to Brazil's Embraer

Tucano despite, the Swiss claim, the RAF's preference for the PC-9. However, Pilatus' co-operation with British Aerospace brought it into the massive deal under which Britain is to supply Saudi Arabia with 132 military aircraft. Pilatus will provide 30 PC-9s as the primary trainer involved in the deal alongside the 30 advanced Hawk jet trainers. The value of the contract for the Swiss has not been disclosed but can be estimated at about SFr 110m (\$65m) and all 30 aircraft will be built in Switzerland. With several unpublished smaller deals, Pilatus now has orders for nearly 130 PC-9s and is expanding the production line at Stans to be able to build 30 a year by 1987, when it should be turning a profit on its new trainer. The PC-9's predecessor, the PC-7 basic trainer, is still in production, for Mexico among other countries. So is the PC-8 Porter utility aircraft, of which 460 have been delivered over the past 27 years, 100 of them built by Fairchild Industries in the US. Now that its future is secure for the next couple of years at least, Pilatus is planning new projects within the sector it has made its own, the highly versatile turbo-prop trainer or utility aircraft.

The SFr 1bn (\$590m) order that Oerlikon's military products division secured in April to supply Canadian land and air forces in Europe with a low-level air defence system undoubtedly weighs heavily in the group's business strategy. It was the first contract for the Adats (air defence and anti-tank system) in developing which Oerlikon has invested more than SFr 500m and it was won in very tough competition with US and other manufacturers, among which Sweden's Bofors proved to be the closest. Oerlikon hopes the Canadian deal can unlock contracts with other Nato countries, among which Belgium, the Netherlands and Turkey have been mentioned. Adats is also being tested by the US army. To win the Canadian order Oerlikon formed a consortium with Litton Systems Canada and agreed to establish a company in Canada to assemble Adats units in a plant to be built at St Jean-sur-Richelieu, Quebec. The company will aim at winning export contracts. The Adats was developed in partnership with Martin Marietta Aerospace of the US. Oerlikon claims that it offers a technological leap ahead in providing ground defence against low-level strike aircraft, which have now acquired the ability to release weapons at greater range and more accurately, and against surprise attack by armed helicopters. It can also be used against ground-based armoured targets at a range considerably greater than those of existing anti-tank systems, according to Oerlikon. Adats' main components are a search and acquisition radar which can handle up to 10 targets simultaneously from the earth's surface up to an altitude of 6,000 metres and a range of 20 kilometres and electro-optical module with a Flir (forward-looking infra-red) imager, an infra-red television camera and a carbon-dioxide laser for missile guidance and missiles with solid fuel boosters capable of accelerating them to a velocity of more than Mach 3 within three seconds. A special characteristic is the defence against jamming. Neither of the two sensors in the electro-optical module are affected by any known jammers and the proximity fuse on the missile is immune to jamming or deception by any currently known electronic counter measures, Oerlikon says. The Adats is a modular system which in its basic form, equipped with eight missiles and a three-man crew, weighs barely four tonnes and can be fitted to light tracked or wheeled vehicles. William Dullforce

Spain

Combat aircraft of great importance

IN ITS report to shareholders this year Construcciones Aeronauticas S.A., Casa, the Spanish public-controlled aerospace company, signalled that its future could be faced with a mixture of hope and confidence. Mr Fernando de Caralt, Casa's chairman, talks of the company being at "a half way stage" and on "a frontier line." Mr Caralt's frontier marks the division that a medium-sized European national company may face between "just getting by" as he puts it, and "being well and truly solid." By 1990, Mr Caralt claims, Casa will have crossed the Rubicon. He expects, four years from now, to have doubled the company's income to Ptas 1000bn. The 1985 results were upbeat and gave substance to such targets. After dipping into Pta 270m losses the previous year, Casa returned pre-tax profits in 1985 of Ptas 1.6bn, the highest annual profit in the company's history. Total income was Pta 47.5bn against Ptas 42.6bn in 1984 and orders at the end of the year were up 30 per cent to total Ptas 77.8bn. Cashflow in 1985 stood at Ptas 2.8bn, up from Ptas 1.1bn the previous year. What Mr Caralt stresses about present state of health is that the company hired more than 200 new engineers during 1985. "I need more grey matter and fewer working hands," he says. The Casa he is building up to 1990 will be a company that has ceased to be what he calls "a giant workshop and nothing more." It is not surprising therefore that he terms a project to build from scratch a combat aircraft for the Spanish Air Force "of capital importance to our future." The new aircraft, codenamed the AX, is presently at the design stage. It is intended to replace the Air Force's F-5s and it will be the result of the growing technology that Casa has acquired. Casa is particularly proud of the carbon fibre expertise developed by its research department. The Spanish company has taken advantage of spin-off deals that followed Spain's purchase of 73 F-16A Tomcats, built by McDonnell Douglas, to supply directly the flaps, fuselage side panels and stabilisers of the US combat aircraft. The stabiliser technology is now being put to use in the Airbus projects in which Casa has a 4.2 per cent stake, and carbon fibre will be also applied, Casa expects, to the Eurofighter project in which the Spanish company has a 13 per cent stake. In addition to the European

consortiums and the McDonnell Douglas link, Casa is also kept in the technology front line through its maintenance contract to overhaul the 100 or so F-15 A's that the US Air Force has deployed in Europe. A further development is the diversification into missiles thanks to the Spanish Government's purchase of 500 Roland missiles from the French-West German Euromissile consortium. Under the terms of the purchase, Casa is to be involved in the manufacture of a further 6,000 Roland warheads for export. The Spanish aerospace company will be building on this technology transfer to develop a wholly Spanish programme for a portable surface-to-air, 2,000-3,000-metre range, missile for the Spanish Defence Ministry. Meanwhile, Casa's C-212 Aviocar, better known as the Jeep with wings, has been a consistently good product, sturdy, versatile and competitive in the short-take-off-and-landing sector. A total of 22 Aviocars were sold in 1985 and a further 14 were sold in kit form. Orders continue to come in and at the latest count there are 390 C-212s flying in 35 countries. The Jeep with wings gave a new twist to its versatility this year when one was sold to the Swedish navy for the specific task of submarine spotting. Casa's second main product line, the advanced jet trainer known as the C-101 which has an updated C-101-5 version, received a fillip this year with the purchase of 16 aircraft by the Jordanian Air Force. Casa executives are anxious to follow up this deal, a breakthrough for the company in the Middle East, with further sales to Arab nations. The C-101 is primarily used by the Spanish Air Force and has also been sold in Latin America. However, the chief interest at present centres on the new product, the CN-235, which is a bi-motor commuter plane that has been developed jointly by the Spanish company and by P. T. Nurtanio of Indonesia. More than 111 CN-235s have been ordered, mostly through the Indonesian sales operation. The first units of the aircraft, which was rolled out in 1983, are scheduled to be delivered in November. The first client is Saudi Arabia. Casa hopes that there will soon be firm orders for the sleek, 40-plus passenger plane on its home ground as Spain's regional, inter-city airlines are built up.

Tom Burns



The Casa C-212 Series 300 is the latest version of the popular and highly-successful Aviocar, built jointly by Casa and Nurtanio of Indonesia

Belgium

A need to join development

AS A SMALL country Belgium has always stressed the virtues of international co-operation. While its principal role as sub-contractor to other people's aerospace projects has brought participation in major programmes such as the F-16 fighter, the European Airbus and the Ariane space vehicle, dependence on the outside world leaves its manufacturers inherently vulnerable in a downturn. There is, nevertheless, a growing awareness of the need to enter new programmes at the development stage, rather than simply buying in an aircraft designed and developed elsewhere and assembling the parts under licence. Since the Second World War, Belgium's aerospace industry, which is based in the southern Walloon region, has relied on "compensations" - work subcontracted back to Belgian manufacturers as a quid pro quo for government orders placed on behalf of the Air Force. Last year's BFR 50bn contract with General Dynamics of the US for 44 additional F-16s was a case in point, the American company agreeing to place about 80 per cent of the business back in Belgium. Local industry is already looking for clues as to how the Air Force will ultimately replace these F-16s - it has about 100 in all - and the 80 or so Mirage jets which the need arises some time in the 1990s.

Belgian aerospace - the Big Three

Company	Turnover (BFRs)		No. of employees	
	1979	1985	1979	1985
Sabca	3.17bn	2.57bn	1,860	1,458
Sonaca	1.87bn	2.63bn	1,578	1,337
FN Moteurs (Fabrique Nationale)	3.21bn	0.65bn	1,821	2,308

Source: European Commission

It is well known, for example, that discussions have been held this year with both Dassault and British Aerospace, with a view to joining either the French Rafale project or the new European Fighter aircraft (EFA) consortium of Britain, Germany, Italy and Spain. Observers feel that collaboration with the French is still the more probable - a stake in the Rafale project would almost certainly be less expensive than the EFA option (and thus attractive to a Government seeking at every corner to trim the budget) while the French fighter is thought to be more specialised for meeting Belgium's Nato commitments. Although early days, the discussions are a measure of the country's keenness to participate in new programmes at an early stage. The other beacon of hope for an industry which lives primarily off defence orders is seen to be the need to replace the armed forces' ageing helicopter fleet. There are a number of possibilities. Sikorsky, for example, has suggested that it could build a new factory if the order went its way - but despite speculation over the last four years the current public spending climate seems likely to delay the project again - perhaps beyond 1987. There are three major companies in the Belgian aerospace sector - Sonaca (Societe Nationale de Construction Aeronautique) and Sabca (Societe Anonyme de Constructions Aeronautiques), which are involved primarily in building airframes, and Fabrique Nationale Herstal (FN) which specialises in engines. Besides the F-16 work - Sonaca for instance is responsible for the final mating of fuselage and vertical stabilisers while FN is building complete F-100 engines for Pratt & Whitney - the Belgian companies are also involved in the civil Airbus programme, in particular the A-310 and the A-320 models. On top of this the sector has a significant 5 per cent plus share in the Ariane space programme with Sabca, for example, designing and developing the hydraulic servo-controls as well as the fins, fairings and the inter reservoir skirts for the Ariane 4 vehicle. The "Big Three" may dominate Belgium's aerospace industry but small companies are playing an increasingly important role notably in the North where the Flemish aerospace consortium FLAG, a grouping of more than 100 companies, reflects the recent change. Formed in 1980, FLAG was largely responsible for winning a roughly 25 per cent share for its members of the "compensations" guaranteed under last year's F-16 contract. FLAG's general manager Mr Herman Candries, is an enthusiastic disciple of the theory that developments in aerospace can be applied in other industries. Perhaps one of the most exciting developments, however, is back in Walloon where the Squalus civil and military trainer aircraft is expected to progress over the next few months. Developed by Promavia, a company whose shareholders include several industrialists, investment companies and a bank, the aircraft has received substantial backing from the Government.

Tim Dickson



A new British airliner making its debut at Farnborough is the British Aerospace Advanced Turbo-prop (ATP), which made its maiden flight earlier this month. Its features include a new six-bladed propeller and an advanced electronic flight deck. The ATP is one of the quietest airliners now flying

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The Netherlands

Construction delays hold up deliveries

FOKKER, the Dutch aerospace group, is levelling off after flying high on a wave of initial orders for its new aircraft, the F-50 and F-100. Mixed orders and construction delays have tempered the euphoric atmosphere that surrounded a bulging order book and record profits last year.

Now Fokker is concentrating on meeting its delivery timetable, putting finances in order and possibly expanding abroad—not to mention obtaining fresh orders. Hopes are pinned on several potential sales of the short-to-medium-haul F-50 and F-100, which would be the first orders this year for the aircraft that were unveiled in the autumn of 1985.

One of the possible sales involves GPA, the Irish aircraft lease company involved in an embarrassing incident in June when newspaper headlines in the Dutch press suggested a record F1 4.5bn (\$2.03bn) order for 100 aircraft. Trading in Fokker shares was temporarily suspended on the Amsterdam Stock Exchange. Fokker denied the story and a week later GPA ordered 96 aircraft from Boeing and McDonnell Douglas, the American aerospace giants.

GPA, which is backed by Guinness Peat and Aer Lingus, has said it is still interested in the F-100, a 100-seat twin jet that is a successor to the F-26 Fellowship. Fokker would clearly welcome the business but is understandably quiet.

Another disappointment was the recent decision by Scandinavian Airline System (SAS) to buy 14 of McDonnell Douglas's MD-87s instead of the F-100 fanjet. Fokker had been thought to have a good chance at the contract, which could have amounted to more than F1 600m.

Construction delays in the F-100 have also proven disappointing. Deliveries of the aircraft originally were to have been made in April 1987 to Swissair, the launch customer, but that has been delayed until the autumn as have deliveries to KLM Royal Dutch Airlines. Swissair has demanded F1 500m in compensation for late delivery of the first of its eight F-100s and the question now is whether KLM will do the same.

Both the F-100 and the F-50, a 50-seat turbo-prop that is a successor to the F-27 Friendship, were announced 2½ years ago as Fokker's new aircraft for

the late 1980s and 1990s. As modernised versions of the F-27 and F-28, they offer operating efficiency, passenger comfort and manoeuvring ease by using new composite materials of great strength and light weight as well as sophisticated cockpit electronics. Because the aircraft are based on existing designs instead of completely original ones, they are supposed to be cheaper to make and lower in price.

A total of 33 orders plus 31 options for the F-100 are in hand and 33 orders plus 10 options for the F-50 but no new contracts have been signed this year. Fokker needs to sell between 150 and 200 of each to recoup its F1 1.2bn in development costs and has planned a production schedule of 60 aircraft a year.

After years of postponement due to buoyant sales, production of both the F-27 and F-28 are being finally halted this year. Described as one of the most successful aircraft in history, the F-27 has chalked up 788 sales in 63 countries over the past 30 years. Since 1969 some 221 F-28s have been sold in 27 countries.

Construction delays in the pair of new aircraft, though, are believed to have played a role in Fokker's request—which was granted—for another F1 100m in financial aid from

the Dutch Government. The Amsterdam-based aircraft maker has received already more than F1 800m from the Hague to help cover development costs.

Fokker insists that development costs have not exceeded the original F1 1.2bn and notes that the government money is in the form of loans and guarantees and not grants. But the company would still like to strengthen further its balance sheet and is considering one or two sizeable share issues.

At least part of the proceeds would be used to help finance a new production plant in the US that Fokker would like to build or buy in an attempt to compete better internationally. With sales spread rather evenly around the globe, the aerospace concern is already international oriented. But a deciding factor in possible US production could be the outcome of a huge order from American airlines for as many as 100 F-100s.

Last year Fokker lost a bid to get a foothold in the North American market through the rescue of the ailing Canadian aerospace company, De Havilland, through a consortium. The Canadian Government-owned De Havilland eventually went to Boeing, giving the jumbo-jet maker an entry into the increasingly competitive short- and medium-haul market.

The loss to Boeing did not

increase Fokker's enthusiasm for taking a 5 per cent stake in the development of Boeing's planned 737 150-seat airliner that will use the revolutionary new propan technology. "We would carry the risk of a prime contractor while we would fulfil the role of a subcontractor," Mr Frans Swartnow, Fokker's chairman, complained to a Dutch newspaper. Fokker is, nevertheless, keenly interested in the propan technology and has an in-house task force studying possible applications.

Meanwhile, Fokker is said to be negotiating with Saudi Arabia for the possible sale of between six and eight F-50s adapted for marine and defence patrol and surveillance. An order of that size would amount to between \$105m and \$140m for the standard aircraft version. It would also most likely involve Holland's Signaalapparaten, the military telecommunications subsidiary of Philips.

In other aerospace developments, the Netherlands agreed in March to participate for F1 7.5m in the research project for a European Space Agency (ESA) satellite. Participation in the F1 160m research phase is mandatory if Dutch industry is to get a chance at bidding for construction of the observation satellite itself.



The Fokker 100 twin-engine jet airliner will have one of the world's most advanced electronic flight decks, giving the crew instant information on the aircraft's systems

Laura Raum

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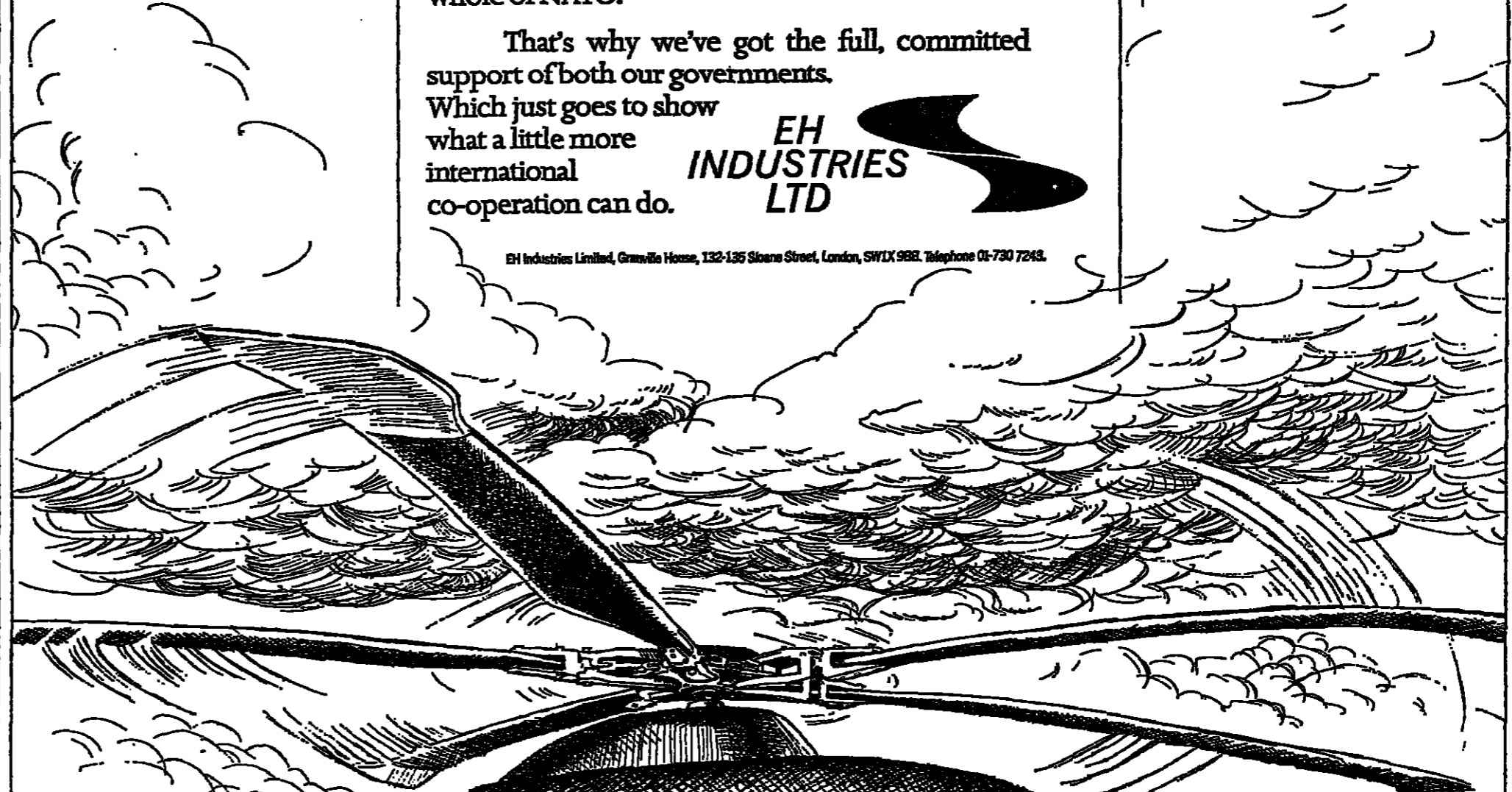
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EUROPEAN HELICOPTER INDUSTRIES

Italy Political bars to merger

THIS IS turning out to be an eventful year for Italy's aerospace industry, which is heavily dependent on defence contracts from home and abroad.

The two main companies, Aeritalia and Agusta, are at the centre of a growing political row about whether they should be merged to create a unified Italian business.

The problem is that Aeritalia is controlled by the IRI-Finmeccanica state holding group, which in turn is influenced by the Christian Democrat Party. The smaller Agusta helicopter maker, which faces other problems as well, is 90 per cent owned by the Eni state holding group, Italy's smallest such state group and close to the tiny Social Democrat Party.

Prof Romano Prodi, the dynamic chairman of IRI, realises that it would make sense to bring the two aerospace companies together. But his patrons in the Christian Democrat Party may not be willing to risk the trade-offs involved in the political bagging which would be required to achieve what in other countries might be seen as intelligent and commonsense industrial rationalisation.

The year made an eventful start when Agusta was a member of the European consortium along with Aerospaciale of France and Messerschmitt of West Germany which made its unsuccessful rescue bid for Westland of the UK.

Not only was the Euro-bid beaten by United Technologies and Fiat, but Agusta and Fiat rowed in public at home over the issue. Once again, political rivalries infected the Italian aerospace industry, doing damage to all concerned.

These problems notwithstanding, the industry did manage a healthy 1.680 trade surplus last year. Total industry turnover increased by 15 per cent to 14,800bn.

Neither Agusta nor Aeritalia are large when compared to aerospace companies in France or Britain. In 1985, for example, Aeritalia's total consolidated turnover came to 11,377bn, while Agusta's rose over 12,126bn. The smaller

and third biggest Italian aerospace company, Aermacchi, had 1985 sales of 1,240bn. Something like 75 per cent of the orders received by Aeritalia and Agusta are defence-related, while Aermacchi is totally defence-oriented.

The boom in exports of recent years appears to be over and certain projects under way, although heavily promoted, have yet to achieve the orders to justify the investment. Take, for example, the Aeritalia-Aermacchi programme to build the AMX light fighter and ground attack aircraft. Brazil's Embraer has 80 per cent of the AMX projects and a production line in Brazil.

Italy and Brazil both hope the AMX will be suitable not just for their own air forces, but also for those of developing countries. But the only orders won so far are the 270 aircraft ordered by Rome and Brasilia.

One achievement, not in the defence area, is the recently-completed civilian turbo-prop computer aircraft built by Aeritalia and Aerospaciale of France. The ATR 42, or Hummingbird, is designed to relieve long-suffering business flyers in Italy. Orders have been picking up.

Back in defence, Aeritalia is hoping to translate the experience it gained on the Anglo-German-Italian Toronado by picking up a larger share of the planned European Fighter Aircraft (EFA) project.

Agusta, meanwhile, is still collaborating with Britain's Westland on the EH-101 naval helicopter. Some 2850m has been spent on developing the EH-101. So far there are only 90 orders which are firm.

There are other examples of Italian aerospace companies working with one another, with foreign companies, and at times in rivalry with some of the same companies.

That a restructuring of the industry would make it more effective appears logical. But the main problem it faces remains not technology or finance: it is the fact that its biggest companies are often subject to political whims rather than industrial logic.

Alan Friedman

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Aerospace 18



Hellenic Aerospace Industry (HAI) has developed a substantial overhaul and maintenance capability for military aircraft. Shown here is a Greek Air Force A-7H Corsair fighter undergoing maintenance

Greece

Breakthrough parts deal

THIS HAS BEEN a breakthrough year for the Hellenic Aerospace Industry (HAI). Following the signing of a FFr 1bn contract in Paris in June, HAI is set to begin manufacture of a range of parts for the Mirage-2000 fighter aircraft, a significant expansion of its manufacturing activities which the Greek state aerospace concern has long been anticipating.

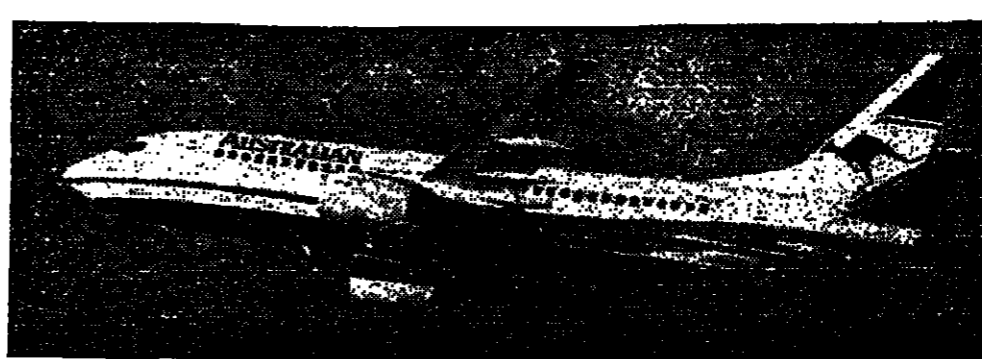
General Dynamics are expected to be completed by mid-autumn. So far, HAI's manufacturing activities have included airbrakes for the Mirage-2000, Airbus doorframes, and, under a kick-off contract signed with British Aerospace last December, valued at \$12m, flap assemblies for the new Advanced Turbo-Prop (ATP) airliner.

In addition the company, whose \$400m plant established in the 1970s with managerial and technological help from Lockheed International represents one of the single largest industrial investments in Greece, saves the state millions of dollars each year in vital foreign exchange by handling repair and maintenance for the Hellenic Air Force, and to a more limited extent the state carrier Olympic Airways.

HAI's role as a foreign exchange earner and saver counters, in the management's view, the fact that the company is running at a loss. HAI is in any case proud of having trimmed losses from Drachmas 1.5bn in 1981 to Drachmas 15m in 1985. The company's foreign debt has also been halved in the same period, from \$320m to \$163m, and the ratio of own to borrowed capital improved from 1:14 to 1:9.

Australia

Offsets policy brings benefits



Australian Airlines, formerly Trans Australia Airlines, is spending more than A\$1bn on new aircraft, including 12 Boeing 737-300s, the first of which (seen above) has now been delivered

As a consolation to Hawker, it was awarded the contract to build the aircraft under licence from Pilatus, a condition Pilatus agreed to in order to clinch the deal. The condition comes under the Australian government's offsets policy which requires foreign suppliers of government contracts worth at least A\$2.5m to pass on part of the contract-related work to Australian industry. The offset work required is at least 30 per cent of the value of the contract. They are required on both civil and defence purchases, and the biggest suppliers so far under the policy are the US, Britain, West Germany, Japan and France.

The aerospace industry in fact stands to benefit the most from the offsets policy, in terms of both contract value and technology transfer. The Defence Department and the government-run airlines are currently on a buying spree for aircraft and equipment, promising profitable contracts for foreign suppliers and Australian companies.

The two major domestic airlines, the government-owned Australian Airlines (previously Trans Australia Airlines) and the privately-run Ansett, have recently ordered A\$2.5bn-worth of aircraft. Although Ansett is a private company, it is covered by the offsets policy which specifies that the requirement will also apply to "organisations having a government-bestowed protective advantage, including aircraft and associated equipment bought by Ansett for use under the two-airline agreement."

worth A\$500m awarded last May to United Technologies of the US. The order was won in the face of strong competition from France's Aerospatiale which offered its Super Fumax helicopter. The first contract was for 14 Sikorsky Black Hawk helicopters which eventually will replace the Royal Australian Air Force's Bell Iroquois UH-1H helicopters. The Air Force plans to acquire up to 100 new helicopters. The second contract worth A\$185m, is for an additional eight Sikorsky Sea Hawks for the Australian Navy, which already has eight of these helicopters. Mr Kim Beazley, the Defence Minister, said the two contracts would generate A\$120m in new work for the Australian aerospace industry. Earlier this year, the Defence Department also awarded a A\$28m order to Italy's Selenia Electronics for two airfield surveillance radars. Selenia had agreed on Australian participation in the design and manufacture of the equipment, Mr Beazley said. Apart from passing on part of the radar-related work to local companies, Selenia had also asked its Australian partner, Ansett Technologies, to manufacture and programme two automated test stations for the maintenance of the radars.

Emilia Tagaza

Brazil

Latest thinking in unorthodox turboprop



A Brasilia airliner nears completion at the Embraer factory

THE Farnborough Air Show is in for some drama as Embraer, Brazil's aircraft manufacturer, shows its new-generation, super pressurised turboprop transport. The yet-unnamed aircraft, designated EMB-123, which has two backward-facing turbo-props attached to the tail section, is an advanced aircraft that makes full use of some of the latest thinking in civil aircraft design. Intended for commuter traffic and carrying a price tag of under \$9.5m, the aircraft is planned for service in 1990 as a replacement for the company's successful Bandeirante, the twin turbo-prop aircraft of which 460 have been sold worldwide since 1972.

On the military side, a new company, AMX International, headquartered in London and capitalised by Embraer and the two Italian partners on the AMX project, is to market the AMX tactical fighter. This aircraft was developed with Aeritalia and Aeritalia for the Italian and Brazilian air forces. At a selling price of \$10.11m, the subsonic fighter is expected to find a niche in both developed countries and the military forces of developing countries. "It has been years since a company manufactured subsonic fighters," Sr Silva says. "The last one was successful since such aircraft provide close air support to attack." Series production is to begin next year in both Italy and Brazil with an exchange of parts for an initial 270 aircraft. Embraer's Tucano, the military trainer, with 130 under order in conjunction with Short

Orlino Carlos da Silva, said the joint undertaking made sense for both countries, since Argentina is Latin America's second-largest market and plans to renew its fleet of aircraft in the near future. "The name of the game is to find partners for the development of a new aircraft who can provide a market and firm orders," Sr Silva says. Embraer is fresh from going it alone in the launch of its popular Brasilia, a 30-seat pressurised turboprop for the state-owned TAI, already been in commercial service for over a year with two regional US airlines and with West Germany's DLT-Deutsche Luftverkehrsgesellschaft flying international flights from Dusseldorf to three UK cities. The Brasilia is expected to be a contender for more services in Europe with the recent changes in air traffic regulations which allow regional airlines to expand their routes to cross-border destinations.

Brook of Belfast to equip Britain's Royal Air Force, is making inroads in Latin American markets as well. Venezuela has ordered as part of a bi-national countertrade arrangement. In late July, Peru signed an order for 20 Tucanos with Brazilian Government financing. The trainer costs \$1.25m to \$1.45m depending on the equipment specified. Because of initial industrial snags in production of the Brasilia, Embraer may find it difficult to reach this year's export sales target of \$287m, double last year's performance. But thanks to improved international sales and strong demand domestically for small private aircraft, total sales are expected to reach \$350m, resulting in a projected return to profitability. Last year, the company reported an operating loss of Cr 200bn (about \$15m at a year-end exchange rate) on sales of Cr 1.5 trillion (million million), nearly \$148m. This was due to heavy investment in R and D and facilities totalling \$119m and reduced demand both at home and abroad. With production lines installed for the Tucano and the Brasilia and facilities ready for the AMX parts production, the company describes last year as one of positioning and consolidation before broadening sales efforts abroad.

Ann Charters

Israel

US pressure to cancel combat aircraft

MORE THAN at any previous moment in its up-and-down history of 30 years, the fate of the Israeli aerospace industry today hangs in the balance. The cancellation of the Lavi is mounting pressure from the US Government for Israel to cancel its most ambitious project yet—the sophisticated Lavi combat aircraft—and replace it with a cheaper, American-made alternative. Between 240 and 300 copies of the aircraft are expected to be built for the Israeli air force by the end of the century, at a unit cost of anywhere between US\$ 14.5m and US\$ 22m. It will serve as a multi-role fighter and ground-attack warplane. However, as executives from the state-owned TAI, Israel Aircraft Industries, and Defence Ministry officials constantly stress: much more than the fate of a single aircraft is at stake. For Israel, the US\$ 2.5bn (at current prices) Lavi project has become a major source of employment, the means to stem a brain drain abroad and, above all, a symbol of the country's determination to achieve as high a degree of self-reliance as possible in the field of armaments. A single-engine aircraft similar to the General Dynamics F-16 Israel already has in service, the Lavi is due to make its maiden flight at the end of next month or in early October. Once airborne, Israeli officials are hoping that the controversy over the project will be much harder to kill. Much will depend on the results of two studies now underway in the US, its chief financier, on the aircraft's current costings and on possible alternatives should it be cancelled. These should be completed before the end of 1986, before the crucial decision has to be taken to move into the production phase. Led by Mr Yitzhak Rabin, the Defence Minister, Israeli officials insist that the country will not abandon the Lavi, describing it as the most thoroughly examined project in the history of the country. Equally importantly, about US\$ 1.1bn has already been committed, much of it US military aid money. Cancellation costs would add another US\$ 250m or so. Cancellation would, inevitably, have a knock-on effect throughout the Israeli economy, much of which is now heavily oriented to the needs of the defence industry. Tamam, the precision instruments division of IAI, would, for example, be brought back in house much of the civilian work it has subcontracted to outsiders if contracts on the Lavi suddenly dried up. Up to 3,000 of IAI's 22,000 employees are directly employed on the project, to which should be added another thousand or so at subcontractors in Israel and the US although it is only at the development stage, the UE aerospace industry already has a substantial stake in the aircraft. Over a hundred pre-production contracts have been left to US companies. Among them are Grumman, makers of the Lavi's composite-material wings and tail section, Pratt and Whitney and Lear Siegler. In the production phase, IAI forecasts that US industry will receive about US\$800m from the project. These considerations notwithstanding, the Pentagon has become the most determined opponent of the aircraft, arguing that it is not cost-effective, and will strain the increasingly stretched US military assistance programme for Israel. Foreign military sales (FMS) grant aid to Israel has reached a record annual figure of US\$1.8bn. But US officials say this peak will be frozen for the coming years, and may even have to be reduced in the light of overall budget considerations. This, at a time when the

demands on those funds from other departments of the Israeli armaments industry are increasing markedly. Senior officers within the Israeli high command have made their objections known in public to the aircraft, regarded as a threat to their own re-equipment programmes. As a substitute, the US is proposing that Israel go for a modified F-16 or else the F-15 which could incorporate the avionics and weapons systems developed for the Lavi. The replacement aircraft would probably be powered by the new Pratt and Whitney 1120 engines intended for the Lavi. Israel originally intended at first to build part, then all, of the 1120 at the Government-owned Bet Shמש engines plant, in which Pratt and Whitney has a 40 per cent holding. But the aero-engine company has been in increasingly difficult financial straits. Losses in its financial year to March 1986 came to over US\$20m, on sales of only US\$18m, and have subsequently continued to mount up at rate of over \$1m a month. Negotiations are thus under way, and five potential Israeli partners, all private concerns, for the purchase of the state's stake. Heading the list of suitors is Koor Industries, the Labour Federation-owned conglomerate which already has a substantial interest in the defence business. One of its subsidiaries, Tadiran, makes an RVV (remotely piloted vehicle) reported to have had considerable export success. For its part, the IAI and the Israeli Government are desperately seeking a US partner to equal footing. This would have the triple advantages of spread-

ing the development costs, lowering the political risks of cancellation and creating a potential export product. The Lavi is a tailor-made aircraft specially designed to meet Israel's own perceived needs in the likely battle grounds of the Middle East during the 1990s. Its strength lies in its ability to penetrate heavy ground-to-air missile defences. It could possibly be recast in a cheaper, export version for sale to other developing countries — provided the US Government agrees — but, so far, none of the major aerospace manufacturers are reported to have shown more than passing interest. Beginning in the early 1960s by assembling French-designed trainer aircraft, IAI has made tremendous strides over the years in developing its own design and manufacturing capabilities. It has also shown considerable ingenuity in modifying existing aircraft, a feature which has become something of a stock-in-trade. In profit since its first year, in its last financial year to March 1986, the state company reported sales of just under US\$1bn, nearly two thirds in the form of exports. Aircraft manufacturing, however, has gradually given way to military electronics and missiles, now the company's mainstay. Within the aircraft division, the place of civilian aircraft has been diminished over the past few years. Annual sales have averaged only US\$70m, and their survival now depends heavily on the Astra, a US\$8.5m executive jet competing in world markets with the Citation III and British Aerospace's 135 jet.

Andrew Whitely

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Aerospace 19

Singapore

Big increase in sub-contract work

ALTHOUGH IT lacks the heavy industrial infrastructure necessary for the manufacture of complete aircraft, Singapore has substantially increased its aerospace activities in recent years.

It has done so largely by providing aircraft and engine overhaul, maintenance and refurbishment facilities; and by supplying electronics and other small components to overseas aerospace manufacturers.

The skills of the Singapore workforce and the encouragement of the Singapore Government led overseas aerospace companies some time ago to sub-contract component and equipment manufacture and assembly to companies in the republic. Today this business provides substantial employment, and makes a significant contribution to the country's economy.

Primarily involved in this business is Singapore Aircraft Industries (SAI), formed early in 1983 as a government-owned industrial group under control of the Ministry of Defence's Singapore Aerospace Maintenance Company. It has five wholly-owned and two jointly-owned subsidiaries, and an overall workforce of some 2,000.

The wholly-owned companies are Singapore Aerospace Maintenance Company (SAMCO), Singapore Electronic and

Engineering (SEE), Singapore Aerospace Manufacturing (SAM), Singapore Aero-Components Overhaul (SACO), and Singapore Aerospace Warehousing and Supplies (SAWS). The jointly owned ventures are Singapore Aero-Engine Overhaul (SAEOL), co-owned with Singapore Airlines; and Sunasero Company, co-owned with Aerospatiale of France.

Collectively, the SAI group has a combined experience of more than 20 years in the aviation industries. The group offers a range of products and services that spans higher-echelon maintenance, and the repair and refurbishment of aircraft such as the C-130 Hercules, A-4 Skyhawk fighter jets, Strikemasters, and US Bell and French Aerospatiale helicopters.

It also offers overhaul and servicing for aircraft-related components: airborne radio, navigational and instrument systems, telecommunications, defence, electronic and weapons systems; test-equipment calibration; and the manufacture of aircraft parts and assemblies.

Singapore's growing interest in aerospace is indicated by the fact that, last January, the third Singapore biennial aerospace exhibition was the biggest yet. Several hundred companies from all over the world exhibited; making it the largest aero-

space exhibition in the Far East and South-East Asia although the Indonesian air show is now a close rival. Most of the western world's major aerospace manufacturers attended.

One reason for this success apart from Singapore's growing direct involvement in aerospace engineering, is that the Far East, and the south-east Asian and Pacific basin as a whole, is the world's fastest growing region in civil aviation. It is described by Mr Cheong Chooing Kong, managing director of Singapore Airlines, as the "future dynamo of the international civil aviation industry."

"It has not only become the focus of growth, but also the catalyst for growth beyond its own boundaries," he says.

"Over the past 20 years, Asia-Pacific has been the world's fastest-growing region."

"It's newly-industrialised countries, spearheaded by Japan, have emerged as major trading forces. All of the region's economies are vigorous, export-orientated, and dedicated to expansion. They provide an attractive environment for foreign investment as well as trade in general."

"The new suns rising in the region have not escaped the attention of the world's trading giants. In 1983, the US-Pacific trade was 24 per cent greater than the US-Europe trade,

having surpassed the latter in 1978."

This situation applies to aerospace manufacturing as well as civil air transport. Many major western aerospace companies now retain offices in Singapore, and have direct links with the growing Singapore aerospace industry. Others plan to, and the biennial Singapore exhibition has had much to do with this. It is proposed to hold the next one at Changi Airport from January 27-31, 1988.

It has been recognised that this form of international aerospace collaboration is the swiftest method of developing high-technology skills, thus helping to promote the economic well-being of the country.

At the same time, the Changi Exhibition brings together the aerospace exports of other countries with an interest in the entire Asia-Pacific arena, with the spin-off effect of promoting Singapore as the focus of aerospace development in the region.

The country faces considerable competition, however. Neighbouring Indonesia is already rising rapidly as an indigenous aircraft manufacturer, especially of light transport aircraft. And the Japanese aerospace industry is a formidable force in world markets, especially since it has the cash

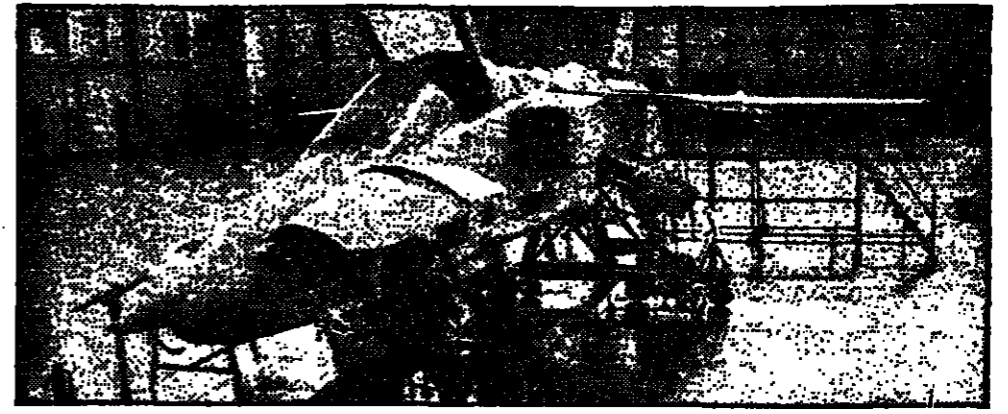
available to buy its way into new western aerospace programmes, such as the projected Boeing 737 prop-fan 150-seat airliner. Malaysia, too, is increasingly interested in promoting its aerospace industry as a potential major contribution to the economy.

Overshadowing everything in far eastern aerospace is the growing power of the People's Republic of China, which, over the past two to three years, has been arranging co-production and other deals with western aerospace manufacturers with a view to modernising its own industry.

Singapore recognises that, with its own limited population and financial resources, it is never likely to become involved in large-scale manufacture of indigenous-designed aircraft, especially in the light of today's rising research, development and production costs, at least on a directly competitive basis with Japan and Communist China.

But, as a major supplier of equipment, components and sub-assemblies, and as a major overhaul, maintenance and refurbishing centre for both civil and military aircraft, it is already a major force in the Asia-Pacific region.

Michael Donne



Final assembly of a Jaguar jet strike-trainer, built under licence by Hindusthan Aeronautics of Bangalore

India

Merger to bring savings

INDIA'S AVIATION is poised for major structural changes in the next year or two following the government's decision to merge Air India, the international carrier, with the domestic Indian Airlines. The complicated work involved in the amalgamation will probably take more than a year but, after it is completed, economies worth about Rupees 1bn are expected.

Both companies are doing well, even at a time when most of the world's airlines are going through a difficult phase. Air India made a record profit of about Rupees 650m in 1985-86, partly from its lucrative Gulf routes, and Indian Airlines made a profit of Rupees 587m.

The reason for the merger decision is the need to reduce overheads and 'avoid duplication of operations, particularly in maintenance and engineering workshops. There is also a great deal of complementarity between them, especially now that Air India has recently added the Airbus A-310 to its fleet.

Indian Airlines already uses the Airbus A-300 on its main trunk routes in the country and on some of its services to neighbouring countries. Earlier this year, it signed a \$1bn contract with Airbus Industrie for 19 Airbus-A320s (with an option for 12 more), and this will give both airlines aircraft made by the same company.

Staff and other economies should be possible as a result, although some resistance from trade unions is likely.

India's third airline, Vayu-

doot, which flies the smaller regional routes, is also expanding fast with its fleet of Dorniers, Fokkers and the Indian-made Avro. It is now examining offers from many countries, including France, Britain and Sweden, for small 40-seat aircraft for further expansion.

Mr. Harsh Vardhan, Vayudoot's chief executive, expects to wipe off the airline's accumulated losses of about Rupees 20m within the next two years. To the 52 destinations on 34 routes, Vayudoot plans to add another 44 this year, to increase its operations substantially.

Two major developments will add to India's growing aviation industry. The government has established a helicopter corporation based on Westland W-30s and Aerospatiale Dauphins. These will help the Oil and Natural Gas Commission's offshore operations as well as provide helicopters for use inside the country.

The government has also decided to permit the use of air taxis in India. These will be based on small executive aircraft already available and so no foreign exchange purchases will be involved. This should fill a long-felt business need for chartering small aircraft.

Militarily, the government-owned Hindusthan Aeronautics is gearing itself to make the latest of the MIG series— agreement was reached in July. The aircraft is the MIG-29, code-named Fulcrum in the West, which so far has been flown only by the Soviet Air Force.

So far, Hindusthan Aeronautics has made only the improved version of the MIG-21 in its three plants that form its MIG complex. Now that the Indian Air Force has decided to make the MIG series its basic aircraft for a decade, newer versions are to be added. The air force is already flying the MIG-23, MIG-25 and MIG-27, and will soon acquire the MIG-29.

These are already being maintained and serviced in the country and their manufacture under licence from the Soviet Union has been agreed. Actual plans for production of particular aircraft will now be worked out according to Russia's willingness to transfer technology for the latest MIG-29.

Hindusthan Aeronautics is already assembling the Jaguar under a deal with British Aerospace but plans to manufacture the Mirage 2000 (40 are to be bought outright and a deal for a few more is expected to be signed soon) have been abandoned.

Hindusthan Aeronautics says that its plans to develop its own "light combat aircraft," which will be used in the 1990s, are on schedule. The airframe has already been designed but until India can make its own gas-turbine engine (coded GTX), the aircraft will be powered by an imported engine.

In the running for this contract are General Electric's F-404 and the Rolls-Royce RB-199.

K. K. Sharma

Indonesia

Commercial battle over military contract

HIGH ambition in the Indonesian aerospace industry has its roots in a decision by President Suharto in the early 1970s to launch the country directly from poverty into technological orbit. Now, after a 15-year record of achievement on a scale which few might have thought possible, the growing aerospace industry is tightly woven around the unusual personality of Dr B. J. Habibie, Indonesia's Minister for Research and Technology.

Dr Habibie is so obsessed with building up this high-technology end of the Indonesian economy that he lives and breathes aeroplanes. The desk in his Jakarta office is crowded with models of advanced aircraft. Design charts of the CN-235, Mr Habibie's

newest aircraft, stand between the piles of documents which he surrounds himself with during his long working day.

Ten years after the establishment of the Nurtanio aircraft factory in Indonesia, Indonesia this year held its first international air show—again with more success than most observers believed likely.

The main result has been a heightening of international interest in Indonesia as a market for high-technology aircraft and as a possible location for component manufacture.

The commercial battle which rages out between the American F-16 manufacturer General Dynamics and the maker of France's Mirage 2000, Marcel Dassault Breguet, was largely as a result of the air show and

a typical product of the Habibie approach.

At the time of writing it seemed likely that Indonesia would still opt for the F-16, but only after the US manufacturer was forced to fight—largely on the proportion of local manufacture—to stay in the race.

Dr Habibie's first dream is aircraft technology for Indonesia; his second centres on local component manufacture at the most sophisticated level. He is aiming to reach the same stage of aerospace technology as European, American and Japanese industries in 10 years.

Another spin-off of the air show was a reported offer by Panavia—the joint venture between Britain, West Germany and Italy—to manufacture the Tornado jet fighter under

licence in Indonesia. But this is still in its early stages.

The most recent development in the industry was an agreement between Boeing and the Indonesian Nusantara Aircraft Manufacturing Co., or IPTN, the new name for the Nurtanio Company, signed during the air show. This involves Boeing taking Indonesian hardware in return for its aircraft.

Indonesia already has agreements with five international groups for the local production of a range of aircraft. The latest involves co-production with Casa of Spain of the jointly-designed CN-235, known in Indonesia as the Tetuko and in Spain as the Elena.

Other agreements are with MBB of West Germany for the production of the BO-105 heli-

copter; with Aerospatiale of France for the Superpuma AF 332 helicopter; and with Bell of the US for the production of the 412 helicopter.

IPTN has an arrangement with General Electric to set up and operate the universal engine maintenance centre in Bandung, the west Java site of IPTN's main factory. The centre is expected to be in full operation by 1988. IPTN also has manufacturing arrangements with the domestic Indonesian airline, Merpati Nusantara Airlines.

IPTN's Bandung aircraft works are already connected with largely unpublished research into missile production at a separate but nearby facility.

Michael Byrnes



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# Aerospace 20

## China

### Links with the West increasing

THE People's Republic of China will be sending a big mission to the Farnborough Air Show.

While the Chinese will have an exhibition in the big covered hall on top of the hill overlooking the runway, which is expected to indicate some of the capabilities of the Chinese aerospace industry, the mission's primary aim will be to discuss with a wide range of Western aerospace industry representatives how they can work together in the years ahead, to their mutual benefit.

The Chinese team will include representatives of China Promotion, China Aviation Supplies Corporation, China National Electronics Import-Export Corporation, China National Aero Technology Import-Export Corporation (Catie), China North Industries Corporation and China Precision Machinery Import-Export Corporation.

Such Chinese missions have been seen increasingly at Western air shows in recent years, reflecting the expanding interest in what the West has to offer technologically in aerospace. The missions also show a readiness to take advantage of the eagerness of Western companies themselves to do business in the vast and growing Chinese aerospace market.

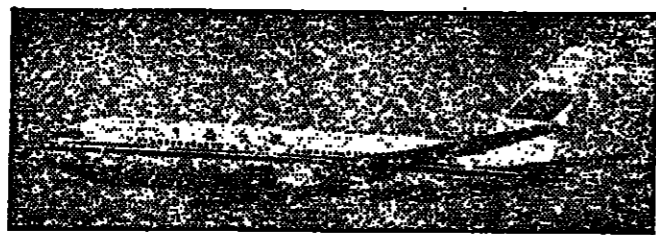
The State aircraft factories are located principally at Shenyang, Xian, Shaanxi, Harbin, Shanghai, Beijing, Nanchang, Hangzhou, Tianjin, Shijiazhuang and Chengdu.

For the early part of the post Second World War period, the industry depended on the manufacture under licence of designs originating in the Soviet Union — before the political rift of 1960 and then the Cultural Revolution, which also affected the aerospace industry with its anti-technology bias.

This dependence on old Soviet designs continues, and is still to be seen across the spectrum of Chinese aerospace activities, including fighters (such as the Shenyang J-8 air superiority aircraft) bombers (such as the Xian H-6 based on the Tupolev Tu-16 or Badger), and the Hangzhou Y-8 four turbo-prop transport derived from the original Antonov An-12.

More recently, the efforts to undertake development from designs other than a Soviet origin have yielded the Shanghai Y-10 four-jet transport.

Although this has similarities



The Chinese Shenyang F-6 fighter, based on the Soviet Union's Mig 19 design (below) and the Boeing twin-engine 767-300 ER (Extended Range) airliner for the Civil Aviation Administration of China.



to the Boeing 707, development began before the first Boeing 707s were sold to China, and the aircraft was undertaken to demonstrate the Chinese industry's ability to develop aircraft of such a size on its own.

However, quantity production of the Y-10 apparently is not intended, at least so far, and the Chinese air transport industry continues to depend on Western manufacturers for most of its modern equipment.

This was apparent at the major Chinese aerospace exhibition, China Aviation Expo '84, in Beijing at which Western manufacturers of all types of aerospace and civil aviation equipment were invited to show what they had to offer.

Not only as a direct result of that exhibition, but also because of some long, hard and patient salesmanship by Western aerospace companies, Chinese purchases of foreign-built civil aircraft have expanded considerably over the past 18 months.

Major deals have included procurement of British Aerospace Type 146 four-engine regional jet airliners, European wide-bodied A-310 Airbus, the smaller Short Brothers Type 360 twin-engine turbo-propeller 36-seat regional aircraft, and

in China including some parts for the BAe-146 regional jet airliner.

The eventual number of MD-80 type aircraft the Chinese will build is not known, but it is recognised that with that country's growing civil air transport industry, its demands through the rest of this century for transport aircraft will run into many hundreds of all types, ranging from small turbo-prop feeder-liners through to big, longer-range types.

The Chinese industry is already showing a strong interest in the emerging prop-fan form of propulsion. The Shanghai Aviation Industrial Corporation has already linked with McDonnell Douglas in the latter's plan to develop the MD-91X prop-fan airliner for the early 1990s.

Also, more recently at the Hannover Air Show, it was announced that the Catic organisation had signed an agreement with the West German Messerschmitt-Bolkow-Blohm to co-operate on the development of a 75-passenger commuter-sized prop-fan airliner, the MPC-75.

The aim is to undertake a feasibility study by mid-1987, and the partners will then decide whether the market will support full-scale development.

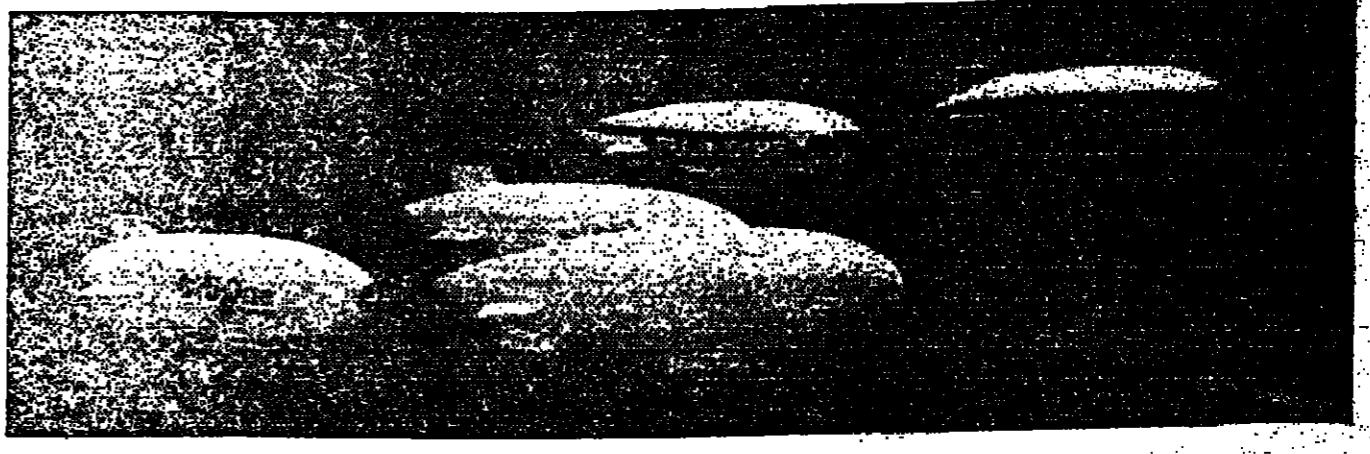
The view is that it most likely will, for it is estimated that the world market for aircraft in the 70 to 90-seat passenger size will amount to more than 800 aircraft by the early 21st century, with China itself likely to need about 250 such aircraft.

This interest in the prop-fan indicates that Chinese aerospace planners are alert to the most recent developments of the Western aerospace industries, and are anxious to get some part in them.

Other manufacturers besides McDonnell Douglas and British Aerospace are anxious to get footholds in the Chinese market, both through direct sales to Chinese airlines (especially as more of these are emerging under the reorganisation of air transport in that country) and through the manufacture of parts and equipment.

Thus, the sales teams are regularly visiting China in growing quantities, and it is hoped that as a result of the strong Chinese presence at the forthcoming Farnborough show, significant further sales will result in the year ahead.

Michael Donne



Impressive line-up of airships built by Airship Industries of the UK shows how production of this type of craft is now expanding, both in the UK and the US, where the company has bases.

## Airships

### Expansion in uses and technology

THERE ARE many companies, in various parts of the world, involved in the manufacture of balloons (either manned or unmanned), and other types of lighter-than-air craft for a wide variety of uses.

However, the two companies most actively engaged in the development of airships—that is, manned, powered and steerable craft capable of carrying passengers and cargo payloads—are Airship Industries of the UK and Goodyear Aerospace, a wholly-owned subsidiary of the Goodyear Tire and Rubber Company of the US.

Goodyear has been involved with airships (which it calls Blimps) for many years, and has built over 300, more than any other company in the world, of which over 250 have been for the US Army and Navy, and the rest commercial craft.

Goodyear currently operates several non-rigid airships for public relations and sales promotion activities, of which the four most recent are the America (NSA), Columbia and Europa (N2A) and Enterprise (N1A).

Goodyear of Akron, Ohio, is now constructing a major new advanced technology airship, called the GZ-25, a nine-passenger craft designed to fly at a speed of about 65 knots, and due to make its maiden flight late next spring.

This craft will be the first in the world to use gas-turbine power, with two Allison 420 hp turbo-propeller engines. It will also include a new electronic control system which replaces the usual mechanical control wires with lightweight electri-

cal connections. Airship Industries, known as AIL, set up in the UK in 1978, is now owned 49 per cent by Bond Corporation of Australia, with Westinghouse Electric of the US holding 3 per cent and Ansett Transport Industries of Australia a small percentage, and the rest in the hands of institutional and private investors.

The Westinghouse interest is part of an overall \$8m deal agreed earlier this year whereby a "joint venture" company was set up in the US by AIL and Westinghouse to pursue military and other business.

A comparable joint venture company has been set up with Ansett Transport Industries, called Asian Pacific Airships, to market airships in the Pacific Basin region. AIL's philosophy is to create further such companies where it can so as to exploit the overall potential of airships as widely as possible.

AIL itself has to date built two separate types of craft—the Skyship 500 and the larger Skyship 600. The Skyship 500, which first flew in 1981, is a four-to six-passenger craft, with a maximum speed of about 55 knots and an endurance (at a speed of 30 knots) of about 19 hours. The larger Skyship 600, which first flew in 1984, is a 12- to 14-passenger craft, with a maximum speed of 60 knots and an endurance of about 24 hours.

AIL says its Skyship series has been designed to make extensive use of advanced high-strength, lightweight materials such as Kevlar, glass-

reinforced plastic and honeycomb sandwich composites. The envelope material, a high-strength, low-permeability polyester, was developed specifically for this range of airships.

The use of non-combustible helium as the lifting gas has eliminated the dangers associated with the earlier use of hydrogen. Power in the Skyship 600 is provided by two turbo-charged Porsche engines, driving five-bladed variable pitch propellers in ducts on either side of the passenger gondola, slung beneath the craft's hull.

The ducts surrounding the propellers serve to reduce propeller noise levels both in the gondola and on the ground, while also improving safety for ground crews and boarding passengers, and increasing overall propeller efficiency.

AIL, with bases at Cardington, Bedfordshire, and Weaverville, North Carolina, now has the largest fleet of airships flying, with a total of nine Skyships operational in the US, Europe, Australia and Japan, another (a Series 600) nearing completion, and two more awaiting assembly.

The company has sold its Skyship 600 craft to Regatta International of Atlantic City, New Jersey, and to Swan Delusion of Perth, Western Australia—the latter craft, which made its maiden flight in May, this year, will be used extensively as a camera platform during the America's Cup yacht races in 1987. AIL has sold a Skyship 500 to Japan Airship Services, a subsidiary of Japan Air Lines. The other craft it uses itself.

Recently, AIL has also submitted a bid to the UK Ministry of Defence in the competition to find an alternative to the delayed Nimrod Airborne Early Warning (AEW) aircraft.

The company is proposing the use of a 100-ton airship which it claims could stay on station for three or four days at a stretch, and have operating costs of only about one-third of a conventional aircraft.

AIL is concentrating a significant volume of its resources on its bid for the big \$40m-plus US Navy contract for an oceanic fleet surveillance airship, under the Navy Airship Programme, or NSP, for which both Goodyear and also Boeing of the US are bidding.

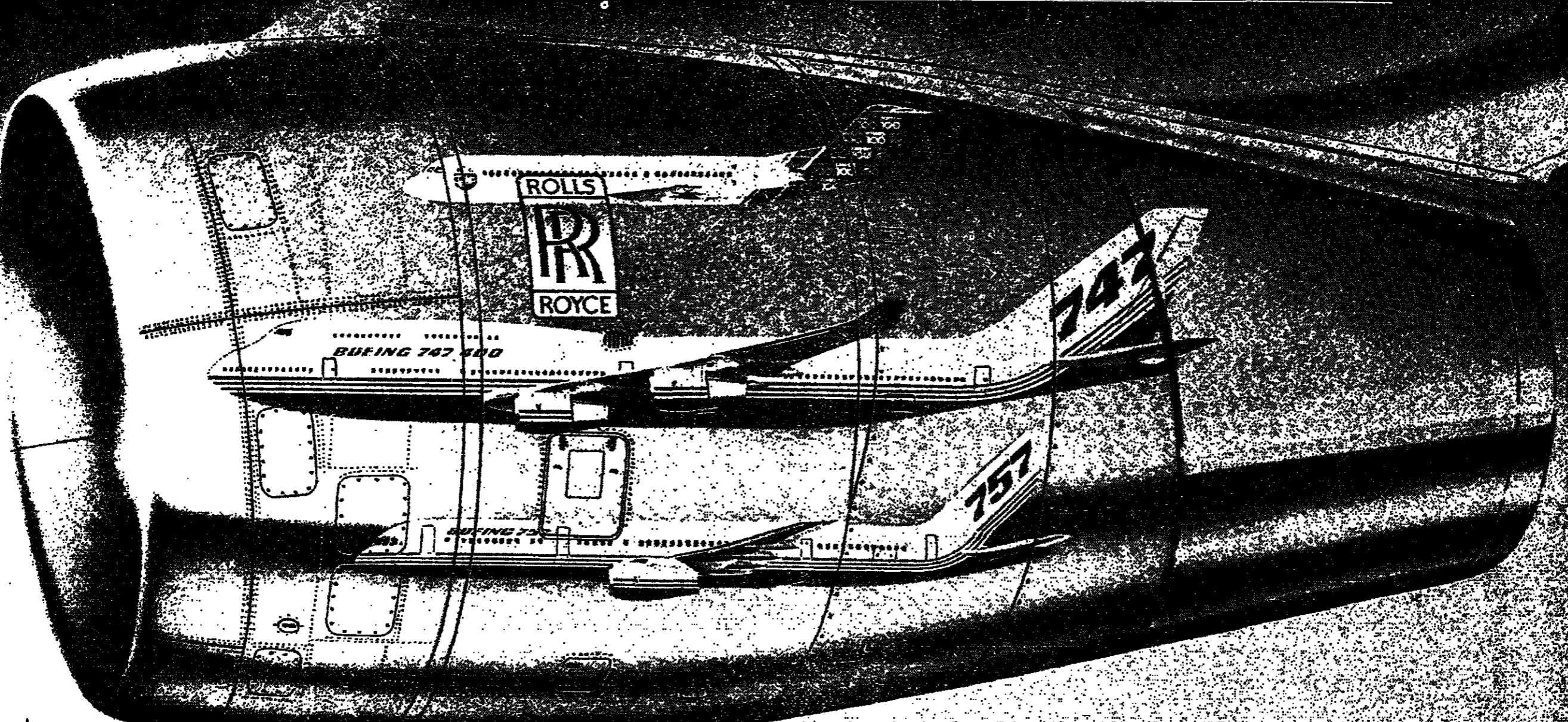
This programme calls for a large "forever-on-station" craft for overhead surveillance of the fleet, with the airships carrying giant antennae capable of detecting incoming cruise missiles.

The studies by AIL and Westinghouse in their joint bid for this contract will be submitted to the US Navy soon, in response to a "Request For Proposal." The US Navy will then take some time to evaluate the proposals from all parties, and a decision may come either later this year or early in 1987.

Whoever wins that contract will be assured of a major airships production programme lasting many years, quite apart from the substantial boost it will give to the ultimate development of commercial airships.

MD

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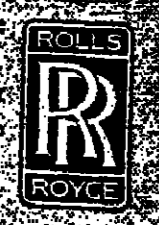
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